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The Farmer's Digest

Volume 12 July, 1948 Number 3

Smother Crops

Condensed from Hoard's Dairyman

E. P. Sylwester

Plant Pathologist, Iowa State College

EVER since man first started tilling the soil, he has had to fight weeds. More progress has been made in chemical and cultural methods of weed control during the last five years than was made during the entire 25-year period before 1942.

Interest in weed-killing chemicals has been nothing short of phenomenal. Never have people been more receptive to good weed control practices. Never have they sought information more eagerly.

Along with a high interest in chemicals and spraying equipment has come an increased consciousness that smother crops can also be invaluable aids in weed control. To really whip the weed problem, we must remember that there are two main ways to control weeds: 1. By means of cultural practices. 2. By the use of chemicals. Both methods are important. Neither is complete in itself, perhaps, and neither is a substitute for the other. Cultural practices and chemicals must supplement one another in a good weed control program.

The farmers who are taking an aggressive stand against the weeds on their farms are taking a renewed interest in cultural practices for weed control—including smother crops. Here are some specific cultural methods to control weeds.

1. Good agricultural seed is the first line of defense against an ever-increasing weed problem. Good crop seed is free from all weed seeds, especially noxious weed seeds. Good seed is pure seed, high in germination. Cheap seed is often the most expensive in the long run. A good, strong, uniform, heavy stand of crops helps to keep weed competion at a minimum. Poor stands contribute to weedy fields.

Reprinted by permission from Hoard's Dairyman, Ft. Atkinson, Wis., April 10, 1948

2. Good rotations control weeds. Weeds such as whorled milkweed, ironweed, vervain, fleabane, yarrow, and ragweed which tend to infest pastures usually disappear readily when the area is again put into clean cultivated crops. Likewise, weeds such as foxtail, barnyard grass, and morning-glory which tend to accumulate in clean cultivated crops are kept under control when the area is put into meadow or pasture.

3. Repeated mowings to prevent weed seed production will quite readily eliminate most annual weeds such as cocklebur, hemp, ragweed, and others. This is extremely valuable in pastures. A good example of effective weed control through mowing is shown alongside our highways. When all annual weeds are prevented from going to seed for two or three years, nothing but a beautiful competitive grass cover remains. A good, thrifty grass cover in itself helps control annual weeds because it helps prevent annual weed seedlings from getting started.

4. Clean cultivation—preparing a good seed bed—is important. Kill as many weeds as possible by repeatedly working the ground before the crop is planted. Perhaps the area can be harrowed after the corn and soybeans are planted and before they come up. This gives the crop a start over the weeds. Cultivation should be shallow but thorough.

5. Spudding, hoeing, and pulling weeds are all effective even if laborious. These practices prevent seed production.

6. Smother crops afford an easy method of weed control. It is true maybe that a little extra effort is needed to prepare the seed bed before the crop is put in and after it is harvested. However, there are big advantages of a smother crop. It affords income from the land while the weeds are being killed. Very little, if any, additional labor is needed during the active growing season when labor demands for other jobs are high. A cover crop eliminates the necessity of regular and thorough cultivations to keep the ground black. Smother crops keep up the productivity of the land which is often impaired during fallowing operations.

Experimental work done in Iowa as well as elsewhere indicates that such heavy, rank-growing annual smother crops as sorghum, sudan grass, millet, and soybeans are very effective against such weed pests as quack grass, perennial sow thistle, Canada thistle, and bindweed (or creeping Jennie), to mention only a few. No crop need ever be lost when fighting these weeds with smother crops. The specific smother crop to use depends to some extent on

the use a farmer can make of the crop after it is grown.

Certain cultural practices add tremendously to the value of smother crops. In order to get best results from smother crops it is necessary to follow the recommended practices as closely as possible. Try to get the maximum amount of damage done to the weeds with a minimum amount of effort. For using smother crops to control such weed pests as quack grass, perennial sow thistle, Canada thistle, and others, the following brief steps are recommended for the control of each weed.

Quack Grass and Perennial Peppergrass

1. Plow the infested area as soon as the weed starts to grow in the spring and as soon as the soil becomes workable and friable.

2. Work the area thoroughly with a spring tooth harrow, combing out as many of the roots as possible. Rake them up and burn them.

3. Work the area repeatedly every week or 10 days, or whenever new weed shoots appear. Use a spring tooth harrow and do a thorough job.

4. About June 1, work the ground thoroughly once more. Prepare a firm seed bed immediately the same or following day and drill inoculated soybeans at the rate of three bushels per acre. Use a grain drill to plant the soybeans, drilling half in one way and crossing the area while drilling the other half. In this way, no barren spaces occur. Sorghum, sudan grass, or millet may be used instead of soybeans if you prefer. While a lower rate of seeding is used when planting sorghum, sudan grass, or millet, be sure to plant enough to get a heavy stand.

5. Harvest the crop at the usual time and plow immediately. Continue cultivation until fall. If any weeds remain in the spring of the second year, repeat the process by starting with step number 2.

Canada Thistle, Perennial Sow Thistle, and Leafy Spurge

1. Plow the infested area as soon as the weeds start to grow in the spring.

2. Work the area thoroughly every week or 10 days, or whenever new weed shoots appear. Use a surface cultivator, a spring tooth harrow, or double disc the area thoroughly. Be sure to do a thorough job.

3. About May 30, plow the area again, a little deeper than the first time. Prepare a firm seed bed and immediately drill in inoculated soybeans the same or following day at the rate of three bushels per acre. Use a grain drill to plant the soybeans. Be sure no areas are missed. Plant half of the

beans one way and then go over the area again crosswise to plant the other half. Sorghum, sudan grass, or millet may also be used.

4. Harvest the crop at the usual time. Plow immediately and repeat the process, beginning with step number 2. Continue cultivation until fall.

5. Repeat the program each year until the weeds are eradicated. Usually 2 or 3 years are required to get rid of perennial weeds.

Bindweed (Creeping Jennie), Horse Nettle, and Russian Knapweed

1. Sow the infested area to small grain in the spring as early as the ground can be worked satisfactorily. Harvest the crop as soon as possible.

2. Plow the stubble as soon as possible after the small grain crop has been harvested.

3. Cultivate the ground at 10-day intervals, or whenever new weed shoots appear. Continue such cultivations until frost, using a surface cultivator or spring tooth harrow. Be sure to do a thorough job.

4. Resume cultivations in the spring when weeds appear. Plow the ground about May 30, prepare a firm seed bed and immediately the same or following day drill in inoculated soybeans at the rate of three bushels per acre. Drill half the beans in one way and half the other so no bare spaces occur in the field. Use only sorghum for horse nettle and knapwood.

5. Harvest the crop at the usual time. Plow immediately, and go through the steps again starting with number 2.

6. Repeat the program each year until weeds are eradicated. It will take more than one year to eradicate deep-rooted perennial weeds.

The cultivations required to control perennial weeds, automatically control many troublesome annual weeds which are often abundant in fields. In fields where the above programs have been followed for 1 or 2 years in succession, the crops are remarkably free from annual weeds. Consequently, these programs are excellent to follow in fields where annual, as well as perennial, weeds have become a problem.

On slightly rolling ground, subject somewhat to erosion, drill soybeans on the contour. Another thing to prevent erosion in such areas, is harvesting the soybean so that rye may be seeded immediately as a cover crop. Use the rye only as a cover crop to guard against erosion. Plow it under the following spring and again seed the area to smother crops. When

weed-infested areas are handled this way, there is little danger of soil erosion and the soybeans may be used as a smother crop even on somewhat rolling land.

On extremely rolling ground, it isn't advisable to summer fallow and grow soybeans. Such crops as sorghum, sudan grass, or millet may be used as a smother crop on areas which are too rolling to use soybeans. Income from such crops are not as great as from soybeans. However, if you can fully utilize such crops as sorghum, sudan grass, or millet, they are excellent for use as smother crops.

Soybeans are a profitable crop to grow. Their value can be increased by utilizing them as perennial weed killers. It is possible to grow this widely adaptable crop to supplement our existing food, feed, protein, and oil supplies. At the same time, it is possible to kill our worst noxious weeds. Low-producing areas, or areas abandoned because of noxious weeds or annual weed infestations, can be reclaimed and put back into production with the above outlined weed-control program. Furthermore, the land will be put into better condition because soybeans help improve the tilth of the soil. Wherever feasible, farmers with weed infestations on their farms should be encouraged to plant smother crops because it is possible to kill perennial weeds and produce a profitable crop at the same time.

Save the Colostrum

What do you do with colostrum, that high-protein milk which cows give the first few milkings after freshening?

Nature intended it to get the calf off to a good start. It's not only high in protein and vitamin A, but also protects young calves against certain diseases, especially infections of the digestive tract.

So your best bet is to feed all of it you can to the new-born calf. If it can't drink all the colostrum, save it. It can be cooled and kept like any other milk.

The Ohio Experiment Station folks say that it's a good feed-saving idea. You can use it quart-for-quart in place of regular milk for other calves.

—Farm Journal

New Killers for Livestock Pests

Condensed from Successful Farming

Ray L. Cuff
National Livestock Loss Prevention Board

ONE of these days it will be a disgrace to have mangy hogs, lousy cattle, or mites in the hen house. Why? Because, it's becoming so easy to get rid of these pests, and others like them.

New killers—good ones, too—are coming from left and right. This news should bring cheers from those of you who know that these pests are costing every farm in the Cornbelt from $100 to $500 and up each year.

We have tested some of these new insect killers on farms and ranches in Kansas and Missouri, and several of the state experiment stations and manufacturers are working with them, too. Here are some of the results.

We've found in BHC (benzene hexachloride) a one-shot treatment for hog mange, and you get the lice at the same time. Hogs are the easiest of all farm livestock to treat with BHC. It's best to handle pigs, rather than big hogs, but BHC works on all sizes.

Get them bunched up, then spray their backs well with a ¼ of 1 percent BHC spray. After that, hold the nozzle close to the ground, using the 45-degree angle nozzle, and hit them on the belly and legs. They will scramble over and over; and while doing so, they'll get BHC all over them.

You don't need a power sprayer, because your garden outfit will do. If it doesn't have a 45-degree angle nozzle or ell, bend the rod.

Some are asking whether BHC will taint the pork. Dr. E. W. Laake, senior entomologist, U. S. Bureau of Entomology, reports that treating a hog with a spray made by mixing 40 pounds of 50 percent, BHC wettable powder with 100 gallons of water did not taint or give any foreign odor to the meat when cooked.

I'd rather spray hogs than dust, but in cold, winter weather it may be better sometimes to keep them dry. In that case, put the hogs in a pen where there is fresh, straw bedding. Dust their backs with BHC powder, and enough will sift down into the straw to control lice and much of the mange effectively.

The practice of sprinkling BHC

Reprinted by permission from Successful Farming, Des Moines, Iowa, February, 1948

powder in hogs' beds helps clear up "rough skin" on the legs of mangy hogs.

Research workers at the University of Nebraska found that one spraying of hogs with a ¼ of 1 percent of the gamma isomer of BHC gave complete riddance of mange. They stress the importance of complete coverage, with care to wet the insides of the ears.

Failures of BHC in controlling mange have been found due to incomplete coverage and using a lower-than-recommended concentration. Since little is known as to poisonous effects of BHC, the Nebraska men caution against using a spray with more than the recommended percentage.

Michigan Experiment Station scientists found that BHC cured hogs of mange even when the animals were in advanced stages. Although pigs at the start had thickened, wrinkled skins and much lost hair, they grew a smooth coat within five weeks after treatment.

With cattle, BHC does a real job of killing not only the active lice, but their eggs as well. Other killers, like DDT, depend on staying on as long as two weeks, but they may get rained off or removed in some other manner. However, BHC is a quick killer and gets everything in a few hours.

In a winter test nearly two years ago, we found that treating a steer, heavily infested with short-nosed lice killed all live lice and stopped the natural development of louse eggs. We used a suspension of ¼ of 1 percent BHC (4 pounds of 50 percent wettable powder to 100 gallons of water). We found that the BHC-treated hair, pulled from the neck of this steer 28 days after treatment, still killed the short-nosed cattle lice.

In cold, disagreeable weather, we found that a hand-operated garden duster did a good job of ridding cattle of lice. This was accomplished by treating cattle thoroughly with 50 percent BHC wettable powder. We found that lightly dusting the beds with BHC helped to control lice on cattle, hogs, and sheep—also ticks on sheep.

Once a terribly lousy heifer was brought in for treatment. Her nose was getting white, and she didn't have strength enough to fight. She was so anemic that she was white, even around the linings of her eyes.

I took an old gunny sack that, before being emptied, had contained 50 percent BHC wettable powder, and rubbed it over her head and tail. Three days later, after thorough examination, we could not find a live louse on her.

BHC is not recommended for cattle grub control. Therefore,

we'll still have to rely on spraying or dusting with derris or cubé (5 percent rotenone).

One thorough dipping of scabby sheep in ½ of 1 percent BHC suspension (8 pounds to 100 gallons of water) cleaned the animals of scab, ticks, and lice. This was done in a cooperative test with a Bureau of Animal Industry inspector and two of our associates, well trained entomologists. These sheep were dipped on September 11, 1947, and held three weeks for examination. At the end of three weeks the scab had cleared, and the skin was dry, pink, and normal.

Taste tests on cooked cuts of these lambs demonstrated that ½ of 1 percent BHC did not impart a foreign odor or taste to the meat.

At the Kansas City stockyards, some of the 50 percent BHC wettable powder was sprinkled around on the floor of a sheep pen. The sheep, badly infested with lice and ticks, were all cleaned up in three days.

BHC works in the hen house, too. We have found that a mixture of 1 pound of 50 percent, BHC wettable powder to 1 gallon of water, painted on the roosts kills lice on the birds, and most of the mites on the roosts. To get the rest of the mites in the house, paint the roosts again in two weeks and spray some of the BHC into cracks where the mites may be hiding.

Remove the old nest litter and burn it, but keep BHC out of the nests and also out of the feed. Otherwise, you'll taint the eggs.

Some of the manufacturers have a process for removing most of the smelly part of the BHC (the delta isomer), but, even so, there's no point in using the insecticide where it may taint eggs or poultry meat.

There has been some criticism of BHC as a roost paint. Some seem to think that, even though only the roosts are painted, the poultry meat may be tainted. So far, at least, this has not been our experience.

We're finding that BHC and DDT mixed together are doing a better job in some cases than either product used alone. In warm weather, BHC gives a quick knock-down, and the DDT gives a long-lasting effect. This combination (4 pounds of 50 percent BHC wettable powder and 8 pounds of 50 percent DDT wettable powder) does a beautiful job of ridding cattle of lice.

The combination is also good for hog lice and mange, and for sheep lice and ticks. With sheep, just drag the nozzle, with at least a number 5 disc, through the wool, using a high-pressure machine. Use a single spray gun with a

number 14 opening, with pressure set at 600 pounds.

BHC, like several other killers, is good in its place, but it does have some drawbacks. The main one is its tendency to volatilize (evaporate) in hot weather. This means that it doesn't stay around so long, although it does a good job while it lasts.

Even regular DDT loses some of its effectiveness during extremely hot, dry weather. We have found that when the mercury hits 99 or 100 for several successive days, regular DDT is only about 75 percent as effective as under cooler conditions. But a new form, Methoxy DDT and D-3, went right along and did a good job even when temperatures rose to 110 out in central Kansas.

Toxaphene (a chlorinated camphene) is another new face among the pest killers. This one was about as effective a fly killer as DDT emulsion in tests last year, but it didn't have a fast knockdown.

Chlordane is making a strong bid for recognition. It's a good product in its place. So far, chlordane has shown more promise with field crops and household pests. It knocks down flies in double-quick time. However, we'll need a few more tests to determine chlordane's place in livestock pest control.

D-3 (a first cousin to DDT) is another newcomer that seems able to stand the heat and rough-going during hot, dry summer months. It's good for flies and lice, and as a barn spray for the stable fly.

Our tests with activated pyrethrins have shown that these materials have a remarkably fast knockdown. Their duration of effectiveness is for relatively short periods, as compared with DDT. We found that these activated pyrethrins knocked down wasps, large horse flies (Tabanids), horn flies, and stable flies almost immediately.

These newer insecticides and methods of application are providing livestock men the means of increasing our nation's meat supply with less feed and no additional animals. In days of food shortages and high prices, we should be feeding people, not parasites. That holds good any time, for that matter.

Farm Managers Challenge Purebred Breeders

Condensed from the Breeders Gazette

D. Howard Doane

GUEST speaker at the annual meeting of the American Society of Farm Managers and Rural Appraisers in Chicago during International week was Sam Guard. He spoke on "Bringing Purebred Livestock Down to Earth." His remarks caused no little discussion and much favorable comment. It was clear to his audience that he is a great believer in, and supporter of, purebred livestock but he also recognizes that purebred breeders have a lot yet to do in order to get many of their practices "down to earth."

I put some rather pointed questions to Sam and he came right back with two for me. He asked, "Do you recommend that a farmer proposing to make money from the commercial production of beef, pork or lamb use purebred sires?"

The answer is yes.

I do not recall a single exception. It may be that in a few instances we have purchased a sire from a purebred breeder who had lost some papers, or there was an objectionable spot or mark on a sire which prevented registration. If such a sire is called a grade, then we have used a few on grade herds.

On many of our commercial farms we purchase young purebred sires, use them as long as possible, and then ship them to market. In the last ten years the market price for the mature bull or boar has exceeded the original cost.

We, in the Doane Agricultural Service, feel that those who raise and sell purebred sires for grade flocks and herds perform a most useful and important service. In the majority of cases these sires have been profitable to us. Farmers who raise purebred sires for commercial producers make a significant contribution to the industry. They are the foundation stone on which a progressive and progressing industry must be built.

The answer, Sam, is that we buy purebred sires, we use them, we recommend them, and we believe in them. The right kind makes us money.

Second question! "Do you recommend the use of purebred *herds* on the farms which the Doane Agricultural Service manages? If you do not recommend

Reprinted by permission from the Breeders Gazette, Spencer, Indiana, May, 1948

that a commercial farmer have a purebred herd, what is your reason?"

I do not think that we have ever voluntarily recommended to a client that he go into or start a purebred breeding herd or flock. We have managed five or more herds of dairy cattle, beef cattle, and hogs that contained 500 head of breeding females, and many herds with fewer numbers. The basis for the further answers to Sam's question is actual experience.

The farms we manage are operated by tenants or directly employed help. Seldom can we find a tenant who will go into the purebred business with the farm owner. I can recall less than a half-dozen cases out of many hundred. This means then that purebreds must be handled by salaried help.

We have found that there are three *musts* in handling purebreds: (a) We must start with superior animals. (b) We must have highly qualified men. (c) We must keep the herd before the public.

In the majority of cases the high-priced end of purebreds is bought by the well-to-do city farmers at prices beyond the reach of those who wish to go into the business on a sound economic basis. Few of us have realized that it is the man who does not have to and does not expect to make money out of his herd who sets the pace for the one who must make money to stay in business. Woe to the man who tries to build a *business* on the same foundation and with the same tools on which the rich man builds his hobby! He, the hobby farmer, lets Uncle Sam absorb from 25 to 75% of his losses while the business farmer takes his straight.

Few persons, regardless of salary paid them, know the art and science of constructive breeding, feeding and handling of purebreds. The best evidence of the truth of this statement is the high rate of mortality among purebred breeders.

We have a client on whose farm there is a purebred dairy herd. The herdsman recently had an offer saying, "You write the terms and tell me when you will be here." Our client had to pay $5,000 a year to hold his man, plus bonuses and generous living expenses. We constantly tell clients that, unless the herd is large enough to justify a man who *knows* the game, there is no chance to succeed.

To keep a herd before the public requires advertising in one or more breed papers, one or more general agricultural journals, frequently in local papers, and in special catalogs and booklets. Stock is supposed to be shown at local, state and national fairs and expositions. The running of a show

herd is a *very* expensive operation in terms of feed and labor at home, travel costs, entry fees, and living costs for attendants while on the road.

If a breeder expects his brother breeders to buy at his sale, he must buy at theirs. He must attend breeders' meetings and sales and shows. In short, he must be a part of the "fraternity" he has joined. The costs come high.

Culling is always a hard task. Every successful livestock man knows it must be done constantly and ruthlessly. Within a month two animals I had planned to keep went to market. The sow did not catch on first breeding and her litter would have been 30 days behind the others. The other animal breathed a little heavy, but otherwise was normal and was eating and doing okay.

Would I have culled them if they had been purebreds? No. These two went to market at no economic loss and the decision to cull was prompt and effective. I had no book write-off.

I know how hard it is to cull an animal with "good papers." I knew a farm where a herd of unsound cows was maintained because they had good papers and might drop some valuable calves. When they were sold, many of them went into the tankage vats although they had cost hundreds of dollars.

Much of the selling of the purebred breeder is on the date set by the purchaser. The commercial breeder selects his dates and sells one as easily as 100 when he can sell to his own best advantage. Just what this means is well appreciated by the man who has seen the heifer calves turn to cows and the bull calves get staggy while he waits for a buyer. If the buyer never comes, it's too late to back up and make fat heifers and smooth steers for market.

Few actual or would-be breeders stop to analyze their market on the basis of their most probable buyers. Any farmer would be quick to see the error that his home town merchants in Smithville made who bought in competition, both as to price and character of merchandise, with the shops that sell on Fifth Avenue in New York or Michigan Boulevard, Chicago. Many farmers do that very thing, then wonder why *they* can't sell $10,000 bulls to the home folks who are regular customers of the catalog houses.

Men who are good livestock handlers are often poor salesmen. Production records are a correct basis for selling dairy cattle, but we have no comparable standard for the meat animals. This throws pricing on a what-the-traffic-will-bear basis—a poor yardstick.

When I go to buy purebred cattle, hogs or sheep, there are two things that the breeders try

to sell me—ribbons and the sale price of some ancestor. Neither of these have I ever been able to take home and translate into true merit and resell to a friend whom I wish to keep as a friend and regular customer.

When I go to the breeder's farm, he either refuses or is reluctant to price his best animals. I decline to buy the culls. When I go to the sales or shows to buy, I find the same animals I saw in the breeder's pasture, so covered up with the feed bucket that I can't tell whether I am buying breeding or sack feed. The breeder presents his wares to the buyer in a condition that *he* will not himself maintain, that *I* will not maintain, and all too often in a condition that destroys or impairs future breeding ability.

Can anyone give sound economic reasons why I should buy and pay for the sale price of an ancestor, often fictitious; . . . ribbons which mean nothing without all the facts concerning the award; fat which may harm the animal as a breeder and certainly does no good and which I will not or cannot retain economically? No one uses such points in selling anything else that I buy. Prices are talked down, not up. It's what the tractor, the seed, or the building does and *will do for me* that salesmen emphasize.

Some *little* things that many breeders do irritate me. I wish I could say that I had never bought a bull from a breeder who retouched his picture, stood his animals in deep straw, or otherwise hid or minimized defects. I always wonder what the breeder is trying to cover up.

Most breeders are honest, of course. Many things that purchasers object to such as long delays in getting papers straight, tests made, and accurate records properly verified, are just mistakes and the result of carelessness. I presume honest breeders have to suffer for the sins of their dishonest associates just as do doctors, lawyers, merchants and farm managers.

I would like to think that purebred breeders are, as a group, more honest that the "mill run" of livestock men. I know how hard it is for some to resist doing little things that are easily covered up. Switched birth dates, good papers from dead cows onto similar living ones, many calves by shy breeding bulls, and mixed earmarks may become temptations too great for some to resist.

I could recite many instances of clear-cut dishonesty in the purchase, sale and showing of purebreds, and, fortunately, many more of honest fair dealing. What we all need to do is to more vigorously weed out the few whose actions reflect on the many who are doing honest constructive breeding, showing and selling.

It is most difficult for any group to clean up its own household. The associations are, of course, made up of, and controlled by, the breeders. Our experience has been that association officials are very slow and apparently reluctant to act when one of their own members is involved. This is understandable but discouraging to the one who has been injured as a result of misrepresentation.

I am not referring to the regrettable practices of some purebred breeders, just to drag out this one point. I mention it as one of the reasons why we do not recommend to our clients that they go into the business.

Does it all pay? Let us endeavor to answer that question with an illustration. We will assume that a man has 100 cows of breeding age. Over the years, using average figures, he should have at least an 80% crop of salable calves. If he is fortunate, it might go to 90%. Of these 80 calves, those kept as replacements and those sold would work out about as follows:

		Heifers		Bulls
Replacements	50%	20	10%	4
Top Sales	10%	4	10%	4
Medium Sales	20%	8	30%	12
Commercial	20%	8	50%	20

What should he get for those sold as breeding stock? We have taken the average sale price of cattle from the largest dairy breed. From these figures each may select his own idea of fair prices.

Average Price Received for All Holstein Cattle Sold at Auction

	Highest Year	Lowest Year
1910 to 1919	$324	$185
1920 to 1929	372	145
1930 to 1939	174	105
1940 to 1947	419	152

The average over the entire period is a little over $200 per head.

We should remember that it takes long years, lots of money, and outstanding records of performance to build a herd up to a point where buyers will pay top prices. Do not be misled by the big play that top prices at top sales get in the papers. Sam, in his November "Country Gentleman" article, said: "The most devastating criticism leveled at the purebred business is the accent on the $50,000 bulls and the $10,000 boars. I certainly do not think these fantastic prices are good for a breed."

The main reason we do not recommend purebred herds to our clients is that in most cases they do not pay. We have found it very difficult to make them pay a return equal to commercial stock on feed fed and labor expended. True, there is some satisfaction and pleasure in seeing good stock on the farm, but much of this is cancelled out by the disappointments which come from poor sales, failing to place in the showring, and being the victim of shady deals.

I realize that this article deals with the negative side of the purebred business. Someday, Sam may ask me to tell what we *do want* in purebreds. If he does, I'll gladly try.

Develop Your Dairy Heifers

Condensed from the Herd Builder

Leland W. Lamb

Reprinted by permission from the Herd Builder, 213 E. Seneca Street, Ithaca, New York, February, 1948

BY "DEVELOPING" a dairy heifer we refer to the process of growing her into a cow in a way that will bring out everything there is in her. Every heifer is born with certain inherited characteristics. We may refer to them as "plans" for a dairy cow. For instance, these plans may call for a 1200 lb. cow at maturity. We all know that in such case it is impossible for this heifer's owner to develop her into more than a 1200 lb. cow, except of course, as he fattens her beyond that weight. But, on the other hand, we also know that many a cow whose original inheritance called for her to be a 1200 lb. cow has been under-developed. Result—a 900 lb. cow, or possibly a 1000 lb. cow.

Obviously, an under-developed cow can never be expected to produce at full inherited capacity—simply because she was not allowed to develop into full inherited size. The production of such a stunted cow can never reflect her true inheritance. For that reason the production records of a group of such undersized cows, daughters of one bull, can never tell us the true breeding value of that bull.

As has been stated, the inheritance of every heifer calf is fixed when she is born. As a matter of fact, her inheritance was fixed at the time the egg, from which she has developed, was fertilized by the sperm cell furnished by that calf's sire.

Each calf is born, then, with definite limitations as to size, shape, and capacity at maturity. Nothing that her owner may do can cause her to develop into a larger size, or a different shape, or of more productive capacity than is called for by her inheritance.

On the other hand, if the cattle breeder is to learn the true inherited capacity of his cows he has an obligation to them, to himself, and in most cases to the breeders of their sires, to develop those cows to full size and capacity. In other words to provide an environment for them that will allow that inheritance to express itself. Thus we have an illustration of the inter-relationship of the much discussed question, heredity and environment as applied to dairy cattle breeding.

As an organization American Dairy Cattle Club devotes much of its attention to attempts to con-

trol and improve the inheritance of our dairy animals. We assist our Associated Breeders in the selection of sires which are either known to transmit desired characteristics to their offspring (proved sires), or which, because of progeny proved pedigree in the case of young bulls, *should* transmit the desired characteristics. It is the writer's considered judgment that we are doing a remarkably good job in sire selection. But, are we matching that selection with an environment for the resulting daughters of our bulls that will allow that inheritance to express itself fully? Each breeder should ask himself that question. To put it another way, do we develop our dairy heifers to full inherited size and capacity prior to production, and do we feed them for full production after they start to produce?

A complete understanding of the interrelationship of inheritance and environment is necessary if one is to do his best at the complicated task of successfully breeding, raising, and developing a high producing dairy herd.

In considering this problem we should keep in mind the undisputed fact that each cow's inheritance places a definite ceiling on her producing ability; that no amount of forced feeding, either in the heifer stage or after producing age will make that cow produce above the limits of her inherited capacity for production. If a cow is fed above her requirements for production—beyond her inherited ability to produce—she will start to lay on flesh. In many cases if she is overfed she will go "off-feed" and refuse to eat. In other cases she will "blow-up" with mastitis if not properly milked. It follows that no matter how large a record a cow makes she could not have made it without the inheritance for it, under the environmental conditions which were provided.

Each cow's production record is merely the product of her inheritance times her environment. If our conversion factors are right all the mature equivalents for any one cow should be approximately the same. Since inheritance can't change, it follows that environmental conditions have changed when one record is materially different from another.

In the following discussion we will be concerned only with providing the environmental conditions prior to first calving that will develop a heifer to full inherited size for her age, and that will give her the reserve condition or body fat at time of calving, needed to carry her through the first few months of heavy production when she probably will not be able to consume as many nutrients and minerals as she gives off each day. Unless a heifer is so developed she will not produce at her full in-

herited capacity. She will carry the resulting low production throughout her life as a blot on her record. An excellent illustration is the case of cow No. 7181:

Her First Mature equivalent was—

9009 lbs. M.—3.42%—
308 lbs. B.F.

Her Second Mature equivalent was—

14550 lbs. M.—3.42%—
498 lbs. B.F.

Theoretically this cow is capable of at least 14550 lbs. milk—498 lbs. B.F. at maturity. Yet she will always carry that 9009 lbs. milk—308 lbs. B.F. first M. E. as a blot on her record—due to under-development prior to calving and during the first part of her first lactation. Not only does this mismanagement give her a black eye, but it puts two strikes against her sire. Also it is, in our opinion unfair to the man who bred her sire.

We are firmly of the opinion that every heifer should first be bred to freshen between August 1 and December 1. This means breeding between November 1 and March 1. This means that fall born heifers must be bred to freshen at approximately 24 months of age and that spring and summer born heifers may be bred to freshen at from 25 to 32 months. Obviously, if a heifer is to freshen at 24 months she needs to be handled differently than if she has up to eight extra months in which to get the growth and development necessary to production at full inheritance capacity.

As the reader considers this discussion he should bear in mind the fact that the urge, or stimulus, to grow is strong in the young animal. Apparently that stimulus diminishes and finally disappears as the animal reaches maturity. For this reason the man who is raising dairy heifers will want to take advantage of this biologic fact. He will want to take advantage of this strong stimulus to grow in the young animal. Because of it growth can be obtained much more cheaply in the young animal than at any later time. Also, it is well to remember that if growth is stopped at any time it can only be started again at great expense. Apparently growth once lost can never be found again. Growth will of course be resumed, but apparently never at its original rate. Thus the animal will always be somewhat smaller than nature intended her to be.

For our purposes it is satisfactory to divide the 24 to 36 months prior to a heifer's first freshening into approximately six months' periods. To simplify our discussion let us call those that are to freshen at 24 to 28 months the "fall-born" group, and those spring born heifers that are to freshen the fall following their second birthday— at from 26 to 32

months—a "spring-born" group, realizing that in unusual cases there may be some overlapping between the two groups. We will consider the fall-born group first. How should they best be handled?

First six months period or first winter:

Since this is the winter season, they will be in the barn. After a good start on milk, or a satisfactory substitute, they will be offered good quality hay as early as they will eat it. This hay should be fed in a rack to prevent waste, and to provide them all they will clean up. Up to four pounds of a good calf starter should be given for the first four months. At this time a good fitting ration should be substituted gradually for the calf starter. The change need not take more than a week. With all the good hay they will eat, four pounds of the fitting ration a day should be sufficient to maintain maximum growth and to prevent over conditioning. Do not overdo the job.

During this period, and after milk has been discontinued fresh, clean water should be kept before them all the time.

There are those who insist that during this period each calf should have a separate pen. This is nice but not necessary. If several calves are running together they should be prevented from sucking each other.

Second six months' period, or first summer:

Roughly speaking this will be their first summer. During this time they should either be kept in the barn or in a separate calf pasture where they can be fed exactly as they would be if they were in the barn—hay in a rack at all times; four pounds of fitting ration a day; plenty of fresh water; sunshine and shade at will, and above all, *exercise*. Continue same schedule until bred at not over 15 months.

Heifers managed in this way should be both old enough and large enough to breed at 15 months. If they aren't there has either been a weak link in your raising system or their inheritance is for size too small to make them profitable to keep.

If there are several heifers in the group and considerable difference in their ages, it will pay to watch them and make sure that the larger ones don't "hog" the feed and thus stunt the younger ones.

Third six months' period, or second winter:

Feeding—Continue with hay as before, or grass silage. Corn silage is O.K. especially after being bred. Up to four pounds fitting ration a day. Just enough to permit them to grow as fast as possible without becoming fat.

Stabling—We believe it is best to have heifers running loose in an open pen or shed, rather than to keep them in stanchions. For ease in feeding and handling they should, of course, be dehorned. While running loose together heat periods may be much more easily detected than if standing in stanchions. Also, the exercise obtained under this system will probably help in getting them to conceive promptly.

Breeding—Many of our most successful breeders are making it a practice to turn a well developed young bull, that has not had previous service, in with the group of heifers to be bred. The best way to assure yourself of a group of fresh heifers starting in August of any year is to turn a well developed young bull in with them on November first of the previous year. Otherwise you will probably be continually plagued by a few "hang-overs"—heifers that should have freshened the fall they were two, but for one reason or another will not freshen until they are nearly three years old.

Fourth six months' period or the second summer:

This is one of the places where well fertilized pasture will be pay off—and well—in big, growthy, well developed heifers, ready to start a year of heavy production. If the pasture is right there should be no need of grain, although well bred heifers will probably return much more than its cost if they get from three to six pounds of grain a day for the last two months prior to calving. If their condition indicates need of grain it is well to run these heifers with the cows beginning six weeks to two months prior to calving.

S*pring-Born Heifers*

First six to ten months' period:

They should be in the barn, with or without an outside paddock. They are too young to benefit by pasture, so it is a mistake to try to pasture them. They will do better if handled in the barn, fed good hay and grain on the same schedule as the fall born calves during their first winter.

Second period or first winter:

Run them loose in a pen with hay in a rack, possibly a small amount of corn silage, but only as an "appeteaser." Grain, two to four pounds a day. Do not breed any of these except possibly a few of the oldest and largest ones late in February. Do not breed any heifers after March 1 unless you need and want more "summer milk."

Third six months' period or second summer:

Plenty of good pasture.

Fourth six months' period, or second winter:

Feed hay in racks, corn silage in limited quantities. No grain should be needed. Breed as soon after November 1 as possible. This is a good place to start with a husky young bull. After November 1 the object is to get them with calf as quickly as possible.

Fifth six months' period, or third summer:

Good pasture, with grain if condition indicates its need, starting about July 1–15. At this time it is well to start running these big fat heifers with the cows to get them used to barn routine.

Recent experiences of successful breeders indicate that grass silage may take the place of hay in the above feeding schedules.

Well bred dairy heifers, developed in the above manner are continually paying off big dividends for their owners in fat milk checks, favorable proved sire records on their sires, and in ready sale for dairy purposes when their own daughters begin to crowd them out of the barn.

Newcastle Vaccine Is Here

Condensed from New Jersey Farm and Garden

NEWCASTLE disease, a nightmare to commercial poultrymen since it was first discovered, may soon become just another vaccinating chore—such as pox or tracheitis. Limited quantities of that long-promised and eagerly-awaited vaccine to combat Newcastle went on sale late in March.

The first permit for the manufacture and distribution of a vaccine for preventive treatment of Newcastle disease in poultry was issued to Wene Poultry Laboratories in March by the Division of Animal Industry of the State Department of Agriculture.

This highly contagious and infectious desease appeared in California in 1939 and has spread throughout the nation, causing serious losses to owners of all types of poultry.

The vaccine developed by Dr. Charles S. Gibbs at Wene's Pleasantville laboratory is a "killed virus" preparation. It is a modification of a similar vaccine that has been used successfully in Japan, Korea and more recently in the Philippines. Dr. Gibbs be-

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lieves it to be more effective than its foreign forbears.

The new vaccine will be used as an intramuscular injection of chicks at the fifth week, and ready-to-lay pullets at the fifth month. It is a preventive, and has no curative properties.

Production of the new vaccine employs partially incubated eggs in which live virus is implanted. After further incubation the embryo, upon which the virus has been propagated, is harvested and the immunizing factor is recovered to produce the killed-virus vaccine.

Advantages claimed for the killed-virus vaccine are that it immunizes the birds and at the same time will not spread the disease in susceptible flocks on the same premises, which cannot be vaccinated at the same time as other birds because of age or other factors. With the killed-virus vaccine any part of a flock can be vaccinated in safety.

The vaccine gives immunity for several months when administered to growing birds, but the vaccination must be repeated at about the time layers are housed. This, according to Dr. Gibbs, should give immunity for the life of the birds.

Somewhat different is the "live virus" vaccine with which Dr. F. R. Beaudette has been working. The live virus vaccine, when and if perfected, will be applied by the stick method. This produces a slight attack of the disease itself, and creates immunity much as is done with other types of vaccines now in use for other diseases.

The point, however, is that poultrymen now have a vaccine which will give them immediate relief from the dread Newcastle which has been taking such a heavy toll that many poultrymen have found themselves virtually out of business.

The following research findings are quoted verbatim from the report of Dr. Gibbs, who has been working quietly in the Wene Laboratories for many months in developing, testing and perfecting the new vaccine. Says Dr. Gibbs:

"Chickens from immune hens cannot be successfully vaccinated until the protection acquired through the egg wears off at about four weeks of age. Even though the chickens are from hens that have not had the disease, it is difficult to successfully vaccinate them under four weeks of age, because they vary in ability to develop immune bodies. Chickens from four weeks of age to just before they start laying can be most satisfactorily vaccinated.

"If the chickens are vaccinated with the killed-virus vaccine at four or five weeks of age and again just before they are placed in the laying house, the results

should be satisfactory. Pullets and cockerels vaccinated in this manner should never have Newcastle disease.

"The site of vaccination is important. The vaccine should be administered intramuscularly with sterile syringes and needles. The dose, except in small chickens and laying pullets, is one-half ml. In chickens under four weeks of age the dose is one-quarter ml, and in laying pullets it is one ml. When Newcastle disease is already on the premises, the birds should be vaccinated in the breast muscles, as immunity is developed sufficiently within two or three days to protect them against the disease. When the disease is not around and the birds are not likely to be exposed to it for a week or longer, they may be vaccinated in the leg. It takes some time for immunity to be fully developed when birds are vaccinated in the muscles of the leg.

"Under laboratory conditions 18 different lots of chicks, five weeks of age, were vaccinated intramuscularly with one-half ml. of Newcastle vaccine, chick embryo origin, killed virus, and challenged two weeks later with one-half ml. of virulent Newcastle virus suspension without a single bird developing the disease. In each of these tests unvaccinated chickens from the same lot as the vaccinated chickens were inoculated with the same virus as was used to challenge the vaccinated chickens and almost 90% of them died from Newcastle disease.

"In the field over 10,000 chickens were vaccinated and exposed to natural outbreaks of Newcastle disease without mortality. In these flocks only a portion of the birds were vaccinated. The rest of the flocks were unvaccinated and served as controls. Although all of the poultrymen did not keep complete records of control flocks it was definitely proved that mortality in these birds was serious. One farmer was so discouraged with the control birds that he sold them for meat before the experiment was finished.

"In another field test 125 pullets just beginning to lay were vaccinated, with neither mortality nor loss in production. These pullets were exposed to the disease, since it was in other flocks on the premises, but three months later they had not come down with it. In the unvaccinated control flocks deaths from Newcastle disease were serious and the birds went out of production for over three weeks.

"These results, while incomplete, indicate that Newcastle vaccine, chick embryo origin, killed-virus, has considerable merit and is the best agent in sight for the control of the American type of Newcastle disease."

Give Electricity a Chance

Condensed from the American Agriculturist

Henry Simons

ELECTRICITY is a wonderful hired man. It is ready at the turn of a switch day or night; and is cheaper for a multitude of farm jobs than hand labor. But on thousands of farms electricity is not accomplishing the work of which it is capable because wiring is not adequate.

When power lines were first extended to rural areas, many customers thought in terms of lights only—and inadequate lighting at that. Many times the wiring provided one bulb in the center of the ceiling of each room. A few lights were provided in the barn, usually on the house circuit. Many old wiring jobs are two-wire installations providing 110 or 115 volts. That is adequate for lights, but because appliances have been added both in the home and in the barn the wiring is now overloaded.

The wires themselves are often too small. A farm wiring installation is like a road. A wide highway will carry traffic freely; a narrow lane results in traffic jams and "bottlenecks." Large wires, like wide highways, will carry a heavy load efficiently.

Often all lights are on one circuit. When an overload results in the blowing of a fuse, the whole installation is out of commission until the fuse is replaced.

In many cases several dangerous or undesirable conditions result from inadequate wiring.

A definite fire hazard is often established, due to overloading and to the fact that some farm owners succumb to the temptation to do a little wiring on their own without having a full appreciation of safety factors.

Because of overloading, the voltage drops until motors start slowly in cold weather and overheat under a normal load. Heating appliances then require a longer time to do the job and, where they are thermostatically controlled, may be operating all or most of the time to maintain the required temperature. Lights flicker and grow dim when equipment is operating.

Your electric bill is higher than necessary because in addition to paying for the electricity you use, you also pay for current consumed in overcoming the resistance of inadequate wiring.

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If your wiring was done some years ago and if you have added equipment since that time, the first step is to have the installation looked over by someone who knows his business. Most power companies now have a farm service man who will be glad to do this and to advise as to the right steps to take.

Whatever changes are made should be done by men qualified to do electric wiring, and the job should be inspected before the "juice" is turned on.

In most cases a complete rewiring job will not be necessary, but some changes will be required. Take, for example, an old wiring job with the main entrance on the house and with wires running from the house to the barn, to the chicken house and maybe to some other buildings. Unless some changes have been made since this was installed, it may be a two-wire, 110 or 115 volt installation. If that is the case, the first job will be to change it to a three-wire, 230 volt.

Any farm that has a considerable amount of equipment needs this kind of an installation. The modern way to do this is to put the main entrance on a centrally located pole with feeder wires going from this main entrance to each building. In each building several circuits will be installed to prevent overloading of any one circuit and to avoid throwing the whole installation out of service in case a fuse blows.

In each building the electrician will supply the number of outlets you want, but it will be to your advantage to insist on plenty. Locate them so that equipment, both in the home and barn, can be plugged in without the use of two or three double sockets and extension cords, resulting in a maze of wiring which closely resembles an octopus.

With adequate wiring the number of jobs that can be done in the home and barn are almost endless. Under our present rate set-up, the more electricity you use the less it will cost you per kilowatt hour. We are all very much aware of the fact that electrical equipment costs money, but the expense seems smaller when we consider the comfort of better living and the lower cost of doing the job with power as compared with hired labor.

How to Pick Better Hogs for Breeding Stock

Condensed from the Farm Journal

Robert H. Grummer

WHAT kind of "luck" will you have with your pigs this year? Care to make a guess as to how many you will wean to the litter, or how much feed it will take to bring 'em to 200 pounds?

Some farmers can tell pretty close—because they keep records on every pig they raise. From these records they select their breeding stock. They know how big each litter is (both size and weight), how much each pig weighs at weaning, and again at five or six months.

One such group of farmers is the Wisconsin Swine Selection Co-operative. This Co-op is directed by five of the state's leading hog raisers, and its program is supervised by the Wisconsin College of Agriculture.

Farmer members (each is assessed a small fee based upon pigs under test) make four recordings on each litter farrowed: size of litter farrowed, size and weight of litter at weaning, and average pig weight at 150 days. In most cases these numbers and weights are either made or checked by the County Agent.

There are three main things involved in pig-raising, "luck"—the feeding, the breeding, and the care and shelter. Feeding and management are the two biggest things in raising hogs. But what about the third—breeding?

You've noticed that some hogs gain faster than others. This is true both in different litters and within a litter. Chances are you don't like this. It makes the herd look uneven. However, it's this unevenness, or variation, which gives you your best chance to select breeding stock which will make you the most money.

No one, however, can accurately select the best breeding stock entirely on what he sees in the hog lot. This unevenness goes beyond what you see with the eye. It extends to the size of litters and their vigor, the "mothering" ability of the sow, and how much feed they eat to produce a pound of pork.

How then can this unevenness be turned to your advantage? That's where sow-testing programs, such as the one in Wisconsin, come in. The pay-off is in what scientists call "heritability." It simply means that some animals

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have the ability to pass along such factors as fast gain and large litters. These figures give a good idea as to how good individual sows (and boars) are.

Animal breeding folks have even been able to tell us about how important this "heritability" is. For instance, both how fast a pig gains, and how much feed it takes, are about 25% heritable. That means in the case of a 150-day weight that about 25% of the difference between pigs is caused by breeding. The other 75% depends on how the pig is fed and cared for.

Size of litter also is influenced by inheritance, although not quite as much as the rate of gain and feed requirements.

In 1947, 825 litters from 148 herds were checked in Wisconsin. In the high one-fourth of the herds, 11 pigs were farrowed per litter, and 9.1 weaned at a total weight of 281 pounds. The average pig weighed *166 pounds at 150 days*. For the low one-fourth of the herds: 7 pigs farrowed per litter, 5.1 weaned at a total of 141 pounds, and each pig averaging *106 pounds at 150 days*.

As you can see, there was a 60-pound difference in weight at 150 days. Since rate of gain is 25% heritable, you could expect to increase the five-month weight of the low herds by 15 pounds, just by selecting the fast-gaining gilts and boars. Likewise, you could also better the litter size, the vigor, and livability of those litters, and their weaning weight.

The possibilities of a hog testing program are much greater than the Dairy Herd Improvement setups. The big reason is in numbers. Because there are so many pigs to choose from, it becomes not merely a culling program, but rather one of selection—selecting the best from the good.

In the Wisconsin Swine Selection Co-operative, college specialists analyze the herd records. Each farmer receives recommendations as to which animals to keep. Also he learns how his herd compares with others.

All records are confidential. This is important because of the variation in care and feeding from farm to farm. The program is strictly designed to help individual herd owners improve their own herds. Naturally, where management appears to be the chief reason for "poor luck," recommendations for improvement are made.

To make more money on hogs you need to eliminate all of the guesswork you can in selecting breeding stock. A selection program like this will do just that.

Dairy Herd Turnover—Is Vitamin D a Factor?

Condensed from the Holstein-Friesian World

Dr. G. C. Wallis

It is common knowledge among practical dairymen that lower turnover in dairy herds means higher income and greater profits. For the first two or two-and-a-half years of her life a cow produces no milk, and therefore is an expense to her owner. After her first freshening, the cow must produce milk for at least two years in order to pay for the cost of her feeding, housing and care up until the end of that time. Abundant records show that, on the average, dairy cows are sold out of herds at about seven years of age. This means that cows, when sold, in general have been yielding a profit for three years at most, sometimes for only two years.

Taking another approach to the problem of dairy herd turnover, let us consider records indicating that about a quarter of the cows in an average herd are sold each year. A few of these animals are sold to other dairy producers for continued dairy use, but beyond question about one out of five dairy cows goes out of production each year.

According to a bulletin published by the Bureau of Dairy Industry of the U. S. Department of Agriculture, a tabulation of more than 10,000 yearly individual cow records from dairy herd improvement associations shows that cows remained in herds an average of 4.7 years from the time they reached production age. This bulletin also cites two similar studies of dairy cow records that arrived at almost the same productive-life averages 4.43 years and 4.85 years respectively. Hence the average dairy cow has a total life of approximately seven years, and lives about a third of her life before she begins to pay for her maintenance. Furthermore, during her less than five productive years the cow is dry for a time before each freshening (perhaps two months or more out of every year) adding up to approximately another dry year out of her life. This unproductive time and the two or more dry years before first freshening made a total of about three and one half unproductive years. Thus, we see that a cow may be unproductive for about half of the average length of time she remains in the herd. Hence, an effective way to increase dairy profits is to keep

Reprinted by permission from the Holstein-Friesian World, Laconia, New York, March 20, 1948

good producing cows in herds past the usual average total age of about 7 years. The Department of Agriculture bulletin cited states, in fact, that the productive lifetime of dairy cows might well be ten years, or double what the average is now.

Why are dairy cows usually lost or removed from herds at such unprofitably early ages? Major reasons commonly given for discarding of dairy cows include low milk yield, failure to breed, udder troubles, injury, or disease. Many animal nutritionists are beginning to feel that ailments responsible for early discarding of dairy cows may be related to nutritional deficiencies, both borderline and acute. Since it has been shown that the milk cow suffers severe physical impairment if she lacks vitamin D, increased recognition is being given to the possibility that insufficient vitamin D intake may be a contributing factor in rapid dairy herd turnover. The principal observations that underlie such recognition of the role of vitamin D in dairy herds follow.

The signs of vitamin D deficiency in dairy cows may be obvious physically, or may be detectable only by laboratory tests. The obvious symptoms of vitamin D deficiency in cows were shown in studies by Wallis in which Holstein cows deprived of vitamin D developed stiffness in the legs and swelling in the knees, hocks, and pastern joints. In the more severe stages humped back and a tilting forward on the toes occurred, and aggravated difficulties in walking. Deficient animals frequently went off feed, showed poor physical condition, lost weight, and exhibited a marked decrease in milk production. Low birth rate and high calf mortality were noted in vitamin D deficient cows, and their calves had a low bone ash and often showed the physical appearances of rickets.

The laboratory tests in connection with the Wallis studies showed that decreases in blood calcium and phosphorus preceded appearance of physical deficiency symptoms, and that increasingly high blood phosphatase occurred later. Cows deficient in vitamin D were unable to utilize calcium and phosphorus efficiently. These cows excreted large quantities of calcium and phosphorus, even though these minerals were fed at favorable ratios and in abundant amounts. The vitamin D content of their butterfat dropped to exceedingly low levels. Blood plasma values dropped to about 0.15 to 0.20 U.S.P. unit of vitamin D per cubic centimeter when mild deficiency became apparent in contrast to a few summer blood plasma samples that showed 5 to 6 U.S.P. units per cubic centimeter.

These observed results of vitamin D deficiency suggest that

common but vaguely defined cow ailments such as winter stiffness, slight impairment in appetite (off-feed), lack of vigor in calves at birth, breeding troubles, general unthriftiness, inefficient production, and what is often referred to as "burnt-out" condition, may frequently have their origin in insufficient vitamin D intake. Since these conditions are among those responsible for the discarding of dairy cows, the possibility that vitamin D deficiency may be a factor in dairy herd turnover is apparent.

An insufficient supply of calcium and phosphorus admittedly may be partially responsible for the appearance in dairy herds of the conditions mentioned. Opinion varies, however, as to the importance of these minerals as primary factors. Mac Ewan claims that the calcium-phosphorus ratio is less important "when vitamin D is present in sufficient abundance." In connection with rickets-like diseases in young cattle, Gullickson, Palmer and Boyd, reported that when "the addition of calcium had previously failed to bring about complete recovery, the addition of a supply of vitamin D brought about complete recovery, or at least great improvement in all cases. These results seem to indicate that vitamin D is the more important of the two factors." At the same time, these authors state that there is "no evidence to indicate that a low intake of phosphorus is a primary etiological factor." With the suggestion that vitamin D is an important factor in the conditions just discussed, it may be of interest to refer briefly to some of the published information on the extent of natural vitamin D sources.

A study has been reported from Oklahoma in which Jersey calves were raised from birth, in individual pens, in a wing of the dairy barn which had windows on the east, south and west. When the weather permitted, these windows and large double doors on the south were kept open. The basal ration was low in vitamin D except for a variable amount in the whole milk fed for the first six weeks. The ration supplied liberal amounts of calcium and phosphorus in a ratio somewhat greater than 1:1. Under these conditions, vitamin D deficiency symptoms generally appeared when the calves were about three months old, and rickets was well established before the calves were six months old.

Replacing some of the beet pulp in the basal rations by prairie hay gave partial protection against rickets. A full hay ration maintained normal blood plasma calcium and phosphorus values, and prevented outward signs of rickets in calves housed under the favorable conditions of this experiment. The authors point out that had

the calcium and phosphorus content of the ration been lower, or had the animals been housed under conditions commonly occurring in actual dairy practice, the hay rations might have given less protection.

In the same study, two heifers on the basal ration received outside exposure whenever possible. Both animals went through gestation, and one through her first lactation, without developing evidences of vitamin D deficiency. The author draws attention, however, to the fact that "the total number of hours of sunshine throughout the year in Oklahoma is high, Oklahoma City ranking fourth in this respect among thirty leading cities in various parts of the nation."

An experiment on sheep, reported by Fitch and Ewer, is also of interest in connection with the value of sunshine as a source of vitamin D. This experiment was carried out in New Zealand, and was made because of the frequent appearance of rickets among sheep on green oats pasture. In this study, the control group, on green oats pasture, developed rickets and made only slight weight gains during the five-month pasture season. Little or no improvement was produced by feeding a similar group a bone-flour supplement once a week. On the other hand, a weekly dose of cod liver oil, estimated to supply an average of about 300 units of vitamin D per day, produced good growth and prevented all but slight histological evidence of rickets.

Evidence of seasonal variation in the benefits of sunshine is also given in experiments conducted by Gullickson and associates of Minnesota. Those workers report that vitamin D deficiency symptoms appear almost invariably "during the season of minimum sunshine" and that "improvement of affected animals is almost always reported in the spring when sunshine is both more abundant and more effective." Regional differences are also cited in the same study: "The wide variation in weather conditions, as well as in the efficacy of the sunshine in different localities during the winter months as reported by Clark (1930), Knudson (1932), and Day (1932), suggests that sunshine alone should not be depended on for this protection."

The limited information available about sun-cured roughages as sources of vitamin D indicates wide variations in their vitamin D content. The development of vitamin D in roughages during sun-curing is a slow, gradual process, and frequently the maximum potencies obtainable are not reached by the time hay is ready for hauling. From a strict dollars-and-cents standpoint, as well as from the standpoint of quality of the finished hay, it would be preferable to

handle roughages so as to produce high carotene (vitamin A) content rather than high vitamin D content.

The increased use of mow-cured, field-baled or dehydrated hay, as well as grass silage serves to improve the vitamin A supplied by roughages, but at the same time tends to decrease their vitamin D content. The following quotation from the Journal of the American Veterinary Medical Association comments on this fact: "Since the advent of grass silage, prenatal rickets is quite common. Heretofore, during the winter months dairymen have depended largely on sun-cured hay to supply vitamin D to dairy animals. With silage supplying most of the roughage, vitamin D deficiencies are common during the winter months. This deficiency is reflected in the unborn calf in the form of rickets."

The natural vitamin D supply from feed sources (mainly sun-cured roughages) probably depends a good deal on the amount and efficacy of sunshine in the locality, the kind and character of roughage and its method of preparation for winter use. Wallis reports the differences in the carotent (vitamin A) and vitamin D content of alfalfa hay under various conditions of sun-curing. Higher concentrations of vitamin D were obtained at the expense of carotene lost by exposure.

Many phases of a discussion of natural sources of vitamin D cannot be covered in this brief article.

Comprehensive studies of the vitamin D stores of dairy cows under different conditions of feeding and management have not been reported. Such information as is available suggests that the dairy cow has only a limited ability to accumulate reserves of vitamin D.

One possible index to the cow's state of nutrition with respect to vitamin D is the amount of this vitamin in her milk. Three studies of this subject were reviewed in the January, 1943, "Vitamin D Digest." These studies showed that, after the summer maximum, there was a rapid decline in the vitamin D content of the milk. If reserves were ample, a more gradual tapering off would be expected and the amount in winter milk would not decline to such low levels.

The vitamin D content of blood plasma in cows may be a better index to the status of vitamin D reserves. In work reported from the South Dakota Experiment Station, Wallis found only about 1 International Unit of vitamin D per cubic centimeter of blood plasma in some cows under practical early winter farm conditions. In contrast, cows under usual summer conditions were found to have 5 to 6 units of vitamin D per cubic centimeter of blood plasma. On

the other hand, those beginning to show other measurable signs of vitamin D deficiency usually had around 0.20 unit per cubic centimeter. The early winter values observed were already far below summer levels, although the severe part of the winter was still ahead.

The continuous high rate of calcium and phosphorus metabolism necessary for the constantly recurring cycle of gestation and lactation demanded of the dairy cow may be an important influence in keeping the vitamin D stores at low levels and in rapidly depleting those stores which may have accumulated.

The occurrence of gross symptoms of rickets in young animals, and indications of borderline or mild vitamin D deficiencies (including less than optimum performance) in cows, suggest the unreliablity of natural sources and of body reserves in meeting the vitamin D needs of dairy cows. Furthermore, the lack of definite signs of a deficiency does not necessarily mean that animals are receiving enough of a given nutrient factor. It is probable that the well-being and profitableness of an animal have been impaired long before recognizable signs of a gross deficiency appear. In this connection it might be pointed out that no definite information as yet shows that "normal summer values" of vitamin D necessarily represent the optimum conditions.

The cost of supplemental vitamin D for feeds varies with the level of fortification used, the quantity purchased, and other such factors. In general, however, feed manufacturers buying in large quantities can provide a regular supply of vitamin D in milking rations or calf meals at a cost of less than 10 cents per ton. Costs of vitamin D supplementation are higher when purchases are made in smaller quantities, but even then the cost is equivalent to that of only a few pounds of feed. This outlay would be compensated by such intangible responses as an increase of 3 or 4 years in the average length of the total productive life of the cow, slight extra vigor in the calf at birth and economy of gain during growth, a saving of 3 or 4 up to 12 or 15 pounds of feed per cow per year, or an increase in milk production of from 3 or 4 up to 10 or 12 pounds per cow per year.

Mow Finishing of Hay

Condensed from Electricity on the Farm

J. B. Stere

In recent years many farmers and research workers have had much experience in completing the curing of hay in the barn. The objective of both research workers and farmers has been to develop a safe, practical, and reliable means of saving, and improving the feeding value of hay.

The development of much of the labor-saving haymaking and handling equipment has been closely related to mow finishing. The equipment for finishing hay in the mow is also usable for drying grain in bins and corn in cribs. This article deals with basic principles of hay finishing and farmers' experiences in applying these principles in high narrow mows.

The amount of water in hay when it is put in the mow determines the drying requirements. It is easy to overload a hay finisher. The amount of water in hay is usually determined by guess. To dry 75% hay requires the removal of 540 gallons of water to get a ton of hay safe for storage. To dry 60% hay one must remove 240 gallons, while from 40% hay only 80 gallons must be removed. Placing 75% hay on a finisher designed for 40% hay would overload it 7 times. That is, one load of 75% hay contains about as much water as 7 loads of 40% hay.

A mow finisher does not do away with the need for field drying. It greatly reduces the time of field drying, and saves losses due to unfavorable weather. For best results, hay should be cured in the field until leaves just begin to shatter when handled.

The amount of air needed to dry a mow of hay depends on temperature of the air, amount of water present in the air, amount of water to be removed from the hay, and the 7 days time before mold damage starts. When these four things are known, the amount of air can be calculated. During good mid-day June weather in Western Pennsylvania, (80°F and 40% relative humidity) one million cubic feet of air will remove 30 gallons of water. In a 20 ton mow, filled with 40% hay, 1600 gallons of water must be removed. That will take $1600 \div 30 = 53.33$ million cu. ft. of air. A fan that delivers 20,000 cfm (cubic feet per minute) will move the 1600

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gallons or 53,330,000 cu. ft. of air in 45 hours if the weather remains favorable and air is forced uniformly through the hay.

There is a practical limit, however, to the amount of air that can be forced through hay. The smallest amount for reasonable drying is 10 cfm for each square foot of mow floor area. The greatest practical amount that can be forced through seems to be in the neighborhood of 25 to 30 cfm per square foot of mow floor area. Large power units can force more than 30 cfm through hay, but the high pressures make their use costly. The high narrow mow usually holds as much hay as the wide shallow mow. To remove the same amount of water in the same time, from the high narrow mow, as in the large shallow mow, larger amounts of air per square foot of floor area must be used. For this reason, the distribution system for one type of mow is not satisfactory for the other type.

Heat for evaporating water from the hay is available from the air, the hay, and fuels such as coal, gas, or oil, and electricity. It is desirable to use as much of the heat of air and as little of the heat of hay as possible. Hay loses some of its feeding value when it heats. Supplemental heat need be used only when experience has shown that in your climate you cannot finish curing hay in the mow in 7 days. If you do use extra heat be sure your fan and ducts distribute the air uniformly through the hay in order that full use is made of the heat. Supplemental heat should not be used to overcome bad management or poor air distribution.

The duct system should offer the least possible resistance to air flow. It should get the air uniformly through the hay. In designing an air system for a particular mow, it is advisable to follow the plans and practices that have been satisfactory in your area. Before trying new ideas, ask the advice of those who have had experience. They may have tried and abandoned the same idea.

The trend in air systems is to eliminate unnecessary distance and turns for the air to travel and to build both the ducts and openings into the hay as large as possible. The duct system is also being kept further away from the edge of the mow to reduce air losses up the walls. Ducts that originally extended to within 2 feet of the edge of the mow are now stopped 6 feet from the edge. If the first few loads of hay are kept away from the edges, the ducts can be kept 8 to 10 feet from the mow's edge.

The two basic types of distribution systems are: restricted system and open system. Restricted systems are used in large shallow mows where small quantities of air (10 to 15 cfm per square foot

of mow floor area) are used. Resistance is built in the system to give uniform distribution and reduce losses. The height of hay in these mows seldom exceeds 10 feet. Open systems are used in higher narrower mows where large quantities of air (15 to 30 cfm per square foot of mow floor area) are used. The hay provides sufficient resistance to give uniform distribution from the duct. When the height of hay above the duct is greater than the distance from the duct to the edge of the mow, vertical ducts are used to direct air to the top for fast drying. About one third of the open systems in use during 1947 used some type of vertical flues. The progress in getting fast drying to a height of 25 feet by use of vertical flues has been very satisfactory.

The distribution system is important to the operation of a finisher. It can restrict the amount of air delivered by the fan, or it can waste air. Both of these conditions interfere with fast drying. The air system must fit your mow, the fan, the kind of hay (whether long loose, chopped, or baled) and the practices you use in filling the mow.

Make your finisher dry hay as fast as possible, to get the best results. For drying be sure the fan is delivering air at its best capacity, run the fan continuously, prevent air losses, recirculation of air, and uneven distribution, and provide big openings in the barn for the moisture laden air to escape.

The best way to get full air delivery from a fan is to keep the resistance to a minimum. Place the hay on the system so it offers the least resistance. Occasionally inspect the belt drive for proper tension. To check for belt slippage, stop the motor and feel the pulleys and belt. If warm the belts are too loose and are slipping. If fan or motor bearings are warm, then belts are too tight. In either case, proper adjustment should be made.

For fast and economical drying, run the fan continuously at least until the hay is nearly dry. There is no need of worrying about putting moisture back into the hay. Experiments have shown that it is almost impossible to add moisture to hay, even when it is dry enough for safe storage. Intermittent operation of the fan permits the hay to ferment and heat. But that extra heat is more than lost in feeding value. Should the weather be damp when hay is nearly dry, intermittent blowing will be necessary to complete the drying.

Air losses through cracks in the floor, along posts and hay chutes waste power and slow-up drying. Recirculation of moist air is avoided by locating the fan so all of the air is drawn from the outside. Wet spots in the mow are

signs of poor field drying, ineffective air distribution, and/or improper mowing.

The most common mistake in operating a finisher is the failure to provide enough openings for the moisture laden air to escape. Remember that tons of water must be carried off by the air passing through the hay.

The Third Pig Doesn't Get to Market

Condensed from Ohio Farmer

J. S. Coffey
Ohio State University

It is a serious indictment against the pig raiser when it can be said that he loses one-third of his pig crop between the time it is farrowed and the time it reaches weaning age. Yet this is approximately what happens throughout the Corn Belt in the United States.

In the hog business it is generally accepted that a five-pig litter just about pays the feed and labor bill in keeping the sow and feeding out the litter. Below that number there is an actual loss while each pig above that number, up to a reasonable limit, provides an increasingly greater profit. Using the five-pig litter as an index of comparison, it may be said that the cost per weaned pig in a six-pig litter is 20 per cent less, in a seven-pig litter it is 30 per cent less and in an eight-pig litter it is 40 per cent less.

The following table prepared from figures obtained from "Pork Production" shows the breakdown on the causes for losses.

Causes of death	Percentage of Pigs farrowed
Overlaying	15.0
Born dead	5.2
Chilled	3.0
Born weak	2.2
Starved	1.5
Eaten by sow	1.1
Scours	0.5
Sore mouth	0.3
Injured by other stock	0.3
Lost	0.1
Smothered	0.1
Miscellaneous	4.8
Total	34.4

A study of the table should suggest to the swine producer that there is much he can do to reduce materially that total figure of 34.4 per cent. In most instances the improvement can be attained through the application of more careful management, while in others proper feeding is the answer to the difficulty.

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Overlaying Causes Most Loss

Nearly half the pigs lost are accounted for by this cause alone. There are many contributing factors that cause a sow to lie on her pigs and crush them. First of all the character of the sow herself may have much to do with it. She may be awkward and unable to get up and down easily. This, of course, would add to the danger of pig crushing. The deaf sow is a menace to newly-born pigs because she is not warned when a pig is dangerously pinched. In other instances the sow is totally devoid of the motherly instinct which gives her concern when one of her progeny squeals in protest as it is pinned down.

The very nature of the newly-born pig itself is conducive to crushing. Even the strongest is not overly active for some time after birth. It easily becomes entangled in bedding and its own umbilical cord, thus making it difficult to escape the impending danger of the sow as she proceeds to lie down. There is even a greater menace to weak pigs which require more time to become strong and active.

The reduction of losses from overlaying begins when the sow is selected for the breeding herd. At this time care should be taken to select sows which are broody, active, and sound in the legs. The next step is to feed the sow during gestation so that she remains active and does not accumulate quantities of surplus fat which tend to make her lethargic. The third step is to provide safeguards in the farrowing pen which will give maximum protection to the newly-born pigs. This involves the provision of a haven of retreat which will guarantee them safety while sleeping. The corner brooder equipped with an electric bulb, provides two important necessities to young pigs, namely, protection and heat. The fourth step in preventing pig losses by overlaying is to feed the sow carefully just before she is due to farrow. Too frequently sows are continued on a heavy ration right up to farrowing time. The heavy feeding aggravates the feverish condition of the sow and predisposes nervousness which in turn leads to pig crushing.

The fifth step in the prevention of pig crushing is to give constant attention to the sow and litter at the time the sow farrows and frequent litter attention for two or three days following. About the only thing the attendant needs to do with a quiet sow as she farrows is to wipe each pig dry as it is born, pinch off the umbilical cord at about two inches from the body of the pig, see that the pig nurses and then place it beneath the brooder or under the guard rail. In the case of nervous sows which want to get up and lie down frequently it is best to nurse the pig, then completely

remove it from the sow until the entire litter is farrowed. From that point on the litter should be nursed every two hours until the time the sow settles down and remains quiet when the pigs are with her.

A good ration to feed sows in gestation when grain saving is a prime motive is as follows:

Grain	40	per cent
Wheat middlings	28	" "
Alfalfa meal	25	" "
Meat scarp	5	" "
Minerals	2	" "
Total	100	" "

Sows should be fed two to three pounds of this ration per 100 pounds live weight daily, depending upon their age and condition. The ration should be reduced considerably just before the sow farrows.

Other Causes Of Losing Pigs

Other causes of pig losses including those born dead, born weak, scours and eaten by the sow are largely the result of improper feeding of the sow during gestation, at the time of farrowing and during the nursing period. With the ration given previously there is not enough grain concentration to cause trouble providing the quantity is given proper regulation. Pigs permitted to lie in damp cold bedding, or which wade about in wet cold grass frequently develop scours resulting from a chilled abdomen.

Such difficulties as sore mouth, thumps and worms, chilling, and injuries, are entirely due to improper management and a lack of sanitation. Thumps in many instances result from anemia which can be prevented by placing good clean sod in the farrowing pen. The pig will mull through the soil and get a sufficient quantity of the necessary minerals to prevent anemia. The best protection against worms, of course, is to follow a rigid system of sanitation.

In successful pig raising it is important to get the pigs out in an environment of soil and sunshine as quickly as possible after they are farrowed. It is always good practice to provide ample rations for nursing sows. It is especially important in cases where the farmer plans to carry his weanling pigs on rather limited grain rations up to the time a new grain crop is available. The well-fed sow will wean a strong, lusty litter better equipped to forage for themselves than pigs which are stunted and unthrifty at the time of weaning.

Facts in Herd Management

Condensed from Guernsey Breeders Journal

Dr. E. J. Perry
New Jersey College of Agriculture

ECONOMY of production should be the criterion of any well managed herd. A comparison of average yields and feed costs for two Guernsey herds recently completing their year's work, affords an example of over-feeding or over-spending, or both, by Mr. A., and possibly a little under pricing by Mr. B. But the respective feed costs reflect quite accurately the amounts of feed used. Both breeders are members of the same Dairy Herd Improvement Association, with the same number of cows. Mr. A received 14 cents more per hundred for his milk than Mr. B., and the butter fat test of his herd was 4.8 percent, compared with 4.7 percent for the other herd. The average figures per cow for the year were:

Owner	Lbs. Milk	Lbs. Fat	Roughage Cost	Grain Cost	Total Feed Cost	Returns Over Feed Cost
A	7736	348	$184	$80	$264	$144
B	6290	296	71	65	136	210

When buying foundation stock it pays to know the twinning records of the families in the herds from which selections are sought. Sometimes the cows with the twinning tendency are the first to be offered for sale. Twinning is an inherited character which occurs more frequently in dairy cattle than in the beef breeds. In some herds it runs 10 percent or higher. Most dairymen consider it an undesirable character because (1) the task of giving birth to twins often leaves the cow in a weak condition that leads to a reduced lactation, and (2) when twins are of unlike sex, there is only about one chance in 12 that the heifer, known as a freemartin, will be a breeder. Furthermore, twins average 70 to 80 percent of the birth weight of single born calves, and they possess less vitality. Approximately 4.2 percent of all calves die young, but the figure for twins is 12.5 percent.

Certain cows need longer rest periods than others. Among these are heifers, especially those that are under-developed, and also cows that are in poor condition.

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Experimental work has shown that a dry period of 45 days, for heifers, increased the yield 33.2 percent in the following lactation, while for older cows the increase was 18.5 percent.

Late experiments have shown that the ovaries of cows ill-nourished in calfhood are frequently abnormal. Some dairymen now keep on hand liberal amounts of "calf hay," the kind that was cut a little earlier than usual, and stored where it is available throughout the winter. This makes the ideal roughage for young stock.

It is more important to know the milk production of our individual cows than to know the fat percentage in their milk, because the extreme variation in their production is five times as great as the variation in their fat test. The average fat percentage of the milk of one complete lactation is a very good indication of the test of subsequent lactations. In a study of Guernsey records, Turner of the Missouri Agricultural Experiment Station found that the first and later lactation percentages were the same in 35 percent of the cases; there was a variation of less than 0.25 percent test in another 47 percent, and only as much as one percent test in one-half of one percent of the cases.

Corn meal, ground wheat, ground barley, and oat hulls, are the grains that have been used as preservatives for grass and legume silage by the New Jersey Agricultural Experiment Station. All proved satisfactory, but the most palatable silage resulted from the use of corn meal, with wheat in second place.

Giving the gutters and walks behind the cows a light covering of superphosphate daily, is a profitable practice. Not only is it a good fertilizer, but according to experiments at the Michigan Veterinary College, it also kills the worst as well as the common germs. In tests, it killed coli, Bang's bacilli and streptococci, in less than 10 minutes.

The Kansas Experiment Station found that cows spent 31 percent more time grazing on poor pasture than on good pasture, and that they laid down an average of two times daily on the former, and four times daily on the latter. Saved energy, as well as ample good feed, always means more milk.

Because cattle seem to like to pick up metal, dairymen should take special pains to get rid of such objects as pieces of baling wire and barbed wire, staples, nails of various kinds, bristles from wire brushes, and other

scraps of metal with sharp ends or cutting edges. Becker of the Florida Agricultural Experiment Station reports a study showing that 59 out of 1,097 dairy bulls died from traumatic pericarditis, or injuries of stomach, liver, lungs, or other organs, caused by nails, baling wire, or other foreign bodies. In 1940, post mortem examinations conducted by Federal veterinarians on 126,979 cattle slaughtered at one station, revealed 6,385 abscessed livers, in 120 (approximately two percent) of which, pieces of wire or nails were found.

Today, many breeders are wisely paying attention to sons of worthy proved bulls, as herd sires. Too often, however, their selections are not from outstanding proved dams—cows that not only have made commendable records themselves, but that have also two or more profitable producings, good type progeny. It is now a well established fact that there is a difference between being able to make good records, and being able to transmit that ability to offspring. The ideal dam also has to her credit a good health history, including years of regular breeding, little or no udder trouble, and a hearty appetite.

If cows could talk, they would remind us that performing what may at first seem to be minor practices, sometimes determine whether a herd is good or fair, profitable or marginal. For instance, cows would remind us to acquaint them gradually with their milk barn environment, and with persons who are to milk them. Seldom do cows become kickers, fussy, nervous types, despised by all dairymen, if they are wisely handled before they have their first calf. Tie them up in the milking line three or four weeks before they freshen, in the stall in which they will be milked.

They would also remind us that they are creatures of habit, and that a regular routine of milking, feeding and general management returns real dividends. The giving of milk is a nervous function, and anything which upsets the cow's tenor of life is quickly reflected in the amount of milk produced. Our young cows would like to tell us, too, that when they have completed their first lactation of 10 months, or thereabouts, they need a little longer dry period than in later years, because of the need for extra growth and development which they require as young cows.

Years ago, hay was thought of solely as a winter feed. If the cows couldn't pick up enough green provender to satisfy their appetites when they were in the *fields,* they were simply pitied. Today, the providing of some hay as a pasture supplement is considered one of the most profitable of all

dairy practices, especially after the herbage becomes a little short or dry. Many dairymen give the cows free access to it in a movable rack. It is well to build a feed bunk along the sides of the rack to prevent waste of leaves that are high in nutritive value.

Range Management

Condensed from The American Hereford Journal

Francis E. Warren

IT IS very difficult for the average run of ranchers to sit down and separate the subject of "Range Management" from the other factors which go to make up the actual operation of a ranch. This does not mean that a great deal of attention is not given to proper range management but rather that many other things enter into the picture. Weather, supplementary feeding program, area involved, type of livestock, markets, labor and many other things change the management program from year to year and have a tendency to subordinate it in the conscious thinking of a rancher.

Consequently, if I get off the beaten track of a strictly range-management discussion, please bear with me, as I feel that, perhaps, the practices of the Warren Live Stock Company may be different enough from the average to add good food for thinking.

In the early stages of our development, we operated, as all other ranches operated in the late 1800's, on free range. The cardinal principal of range management in those days was to get control of the water and you had all the free range you could handle. No one worried about percentage of forage grazed as long as the stock stayed in fair condition. The smart operator was the man who had the most livestock in numbers and had enough watering places for them. In our particular case, for example, we were running over 75,000 sheep plus cattle and horses; and although I have no exact information, to the best of my knowledge we owned less than one-fifth of the land we now own.

Slowly this free land was taken up in various ways, and we found it increasingly necessary to secure more and more deeded land and private leased land if we were going to stay in business. About the time of World War I, we reached

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a position of 40 percent deeded and 60 percent private lease. Later in the '20s we had about a 50-50 breakdown. At present, we own 73 percent, have private and state leases on 27 percent and have only one small forest permit for 1,200 sheep and about five sections of Taylor Act land.

This set-up is not an ordinary one for this part of the country and, as a result, presents problems in range management and control which are somewhat different from those other outfits have to contend with. It goes without saying that such an overwhelming percentage of deeded and private leased land makes for a very high operating cost.

To counteract this cost, it is fundamentally necessary to get the most out of the range—not by large numbers of livestock which would deplete the range—but by running higher-unit-income stock under a management program which will get the most out of the forage over a long term period. Here again we run into the same difficulty of separating range management from other factors involved. Under this high operation cost set-up, it would be suicide to just worry about proper management without working toward better quality, more desirable stock; however, the good range management of this same stock is basically mandatory.

Over many years, a plan of management has been worked out which seems to be doing the job. It is not perfect nor is it the brain child of any one individual; rather, it is the result of trial and error and something which is open to change and improvement at all times. Such must be the case to meet changing conditions.

The Warren Live Stock Company is located in a half-circle to the north, west and south of Cheyenne. It covers somewhat over 300,000 acres and is divided into two management units known as the North and South Sides, each with its general foreman. In turn, these two units are subdivided into winter and summer ranges, giving four distinct areas to cover.

The North Side represents about 40 percent of the acreage and is managed by the North Side general foreman and under him a ranch gang-boss. The South Side makes up 60 percent of the range and is managed by the South Side general foreman and under him a sheep foreman and a ranch gang-boss. The cattle foreman has charge of all cattle North and South but is subordinate to the general foreman and takes the latter's suggestions as to proper range management depending on where the cattle are located. The co-ordination of the North and South Sides is handled through the managing vice-president who works from the office in Cheyenne.

Semi-monthly meetings are held with both general foremen, the secretary-treasurer, the manager, and Fred E. Warren present to discuss all problems and properly co-ordinate all operations for the company as a whole. Practically speaking, the North and South Sides operate identically with respect to management problems.

There are several general practices which bear discussion before going into specific problems. They are, we feel, applicable to all stock raising on range feed.

Water assumes prime importance for maximum food benefit. In an area not plentifully blessed with natural water, this one requirement has probably given us more headaches than any other. Originally, most of our winter range depended on snow or on long trails of four or five miles to natural water. It was considered adequate if a bunch of sheep had water every other day when there was no snow on the ground; and if there was snow, they were not taken to water until the ground was bare again. It took many years to figure out that these sheep were in poor condition not from lack of feed but from lack of water. Our practice now is a direct reversal of this. No bunch of sheep is ever over two miles from water, and we would rather cut this to one mile. Even with soft snow on the ground, they are taken to water every other day and every day when there is no snow.

We have found that snow is no substitute for ample, good drinking water. Stock may suffer a water shortage on snow as badly as if the range were bare. In order to provide this water, it has been necessary to drill and outfit in the neighborhood of 80 to 85 water wells. Expensive as this may be, it has shown untold benefits in stock condition and in better utilization of range forage.

This same need for adequate, accessible water has been found to hold true with cattle as well as sheep. It has the further advantage, with cattle, of breaking them up into smaller, more scattered bunches which benefits the range feed. Our typical water set-up is a well 100 to 500 feet deep, windmill and tower, large buried and covered storage tank, sheep trough and a cattle tank.

It has been proved by experience that salt is one of the cheapest supplements to a range forage diet. In the case of sheep, we use a standard sheep size granular salt and feed it in troughs at the car or wagon. Usually we use three troughs about 16 feet by six inches by eight inches and we keep salt before the sheep at all times. We do not subscribe to the theory of salting once or twice a week or when the sheep are salt hungry but feel that they should be given

free opportunity to have salt at all times.

With cattle we find that the most satisfactory plan is to feed block salt at the watering places, keeping it before the cattle at all times.

Through many experiments, analyses, and tests, the soil in the area we run on has been found deficient in phosphorus. The problem, then, of mineral supplement is one which must be considered and solved to get the best out of the forage.

Since we are low only in phosphorus and since experiments have shown that a proper calcium-phosphorus balance must be maintained, we, of necessity, require a mineral supplement high in phosphorus and low in calcium. Actually, deodorized steamed bone meal mixed with salt is our cheapest source; however, because of its physical characteristics, we have had difficulty with it blowing out of the mixture. As a result, we are now using mineralized sheep salt and cattle blocks. This, again, is kept before the stock at all times with a free choice of two troughs or blocks of plain salt to one of mineralized.

It is surprising the amount of variation in consumption of mineralized salt in various localities and during various seasons. We feel that this variation confirms our thinking that an animal instinctively knows best what it needs in such matters.

In the case of supplementary protein feeding, we probably go to extremes compared to most ranches. Again, tests have shown the steady loss of protein in range forage in our area during the months of December to May, and we feel that in order adequately to prepare our stock for lambing and calving we must replace this loss plus a little more by supplementary protein feeding. Logically, it is wrong to deprive animals of protein at the very time when they need it the most to produce a sound and healthy offspring. It is, furthermore, poor thinking to deprive and consequently stunt the growth of a growing young animal like a colt, calf or ewe lamb during these same low protein months when the weather is usually most severe.

Specifically now, let's get into the range-management practices of the Warren Live Stock Company during a typical year—first, the sheep during the winter, lambing season and summer and then the cattle, winter and summer.

In October after shipping and ewe lamb selection is finished, the bunches are made up for winter. We have found that, with our system, bunch size is an important factor in stock condition and most efficient range utilization. This year, for example, our largest band numbers 1,850 head and the smallest 1,450. The spread in size is caused by working out the six or

seven lambing shifts for breeding so that our sheds will accommodate them in the spring. Theoretically, we would prefer our aged ewe bands to run about 1,700 to 1,800 head, our yearling-coming-two band 1,650 to 1,700, and our ewe lamb bands somewhere between 1,400 and 1,500. These numbers have proved out over many years to be the optimum for each age involved.

Perhaps these bunch sizes may strike some as being smaller than most people believe are economical, but they are one of our conceptions of proper range management. We believe that by using smaller size bands and moving them to fresh camps more often that we gain in several ways and greatly overcome the added cost of extra herders and greater number of permanent camp installations.

Change of range, even if the camps are only three or four miles apart, will work wonders in keeping sheep satisfied and contented. Many times we will move off a range with one band and move another band on to the same range to finish grazing it.

This desire "to see the other side of the mountain" is a basic point in sheep psychology; and if a band is kept on one range after the sheep go stale on it, they simply hunt new pasture until they destroy most of the remaining forage by their trailing. Even the best herder cannot combat this urge.

We shed lamb all of our sheep starting March 1 in order to get a heavier, more desirable lamb by shipping time. Most of the camps are located along natural water and consist of a main shed, six woven-wire pastures with small sheds, and a large woven-wire pasture with a shed large enough to hold 300 ewes and lambs.

The sheep are brought into the camp in shifts so that a fairly constant number of 1,250 to 1,500 are in the drop bunch at all times. As they lamb out, they run through the small pastures in bunches of 60 to 80 head. These small bunches are doubled into the large pasture until a bunch of 300 is made up to be moved out from the camp. These 300 bunches then go out on the range through a series of shed camps. As they progress further out and get older, two 300 bunches are doubled and these 600 bunches are run, as such, until close to shearing time, the first of June. At shearing time, they are doubled again to make up our standard summer band of 1,200 ewes and 1,200 lambs less drys and loss.

The original problems of range management in this style of lambing were many and varied. The location of camps and sheds required a great deal of detailed study to assure an uninterrupted flow of sheep to and from the

lambing camp even under adverse weather conditions. Bunch size, shed size and other factors also had to be considered. However, now that the basic system has been worked out, the range management problems are small and require little attention as we supplement heavily with both cake and alfalfa.

To get into the cattle business for a while now, I'd like to run briefly through the winter operations and then spend a little more time on the summer months.

We reserve two pastures for our cows and heifers to graze during the winter months. Our two-year-old steers are pastured until about January and then go onto the meadows for hay and concentrate feeding until green grass starts. Our calves go into the meadows on hay and cake as soon as they are weaned and are fed straight through until green grass. Ordinarily, we do not have to hay-feed our cows as the pasture they are on during the winter is sufficient to carry them through; however, in the event of extremely bad weather or poor pasture conditions we do feed both concentrates and hay before calving.

All our cattle are summered on the winter sheep range. We feel that we have worked out a dual-use system here that would greatly benefit others in the sheep industry as well as ourselves. It has many advantages and few drawbacks. In the final analysis, the expense of a few cowboys, a little hay and cake during the winter, two winter pastures and the installation of cattle tanks at our sheep windmills is the sum total addition cost above that required to operate our sheep. On the income side of the picture, we gain the proceeds from the sale of offsprings from about 1,000 breeding cows.

The secret, of making this dual-use system work is a simple matter of determining the percentage of forage the cattle can be allowed to take off the range during the summer months without seriously reducing winter sheep feed. We have found that if the cattle are lightly grazed, they will first eat the tall, ranker grass that the sheep will not eat when it is dried out. Thus, we do not injure the sheep feed to any great extent.

For our particular area, we have evolved a formula for cattle usage during the summer which gives the proper grazing percentage. We use a figure of two to three and a half cow days per acre depending on the density and type of forage and the supply of water in the pasture. For example: A pasture of 10,000 acres is given a summer cattle use rating of three cow days per acre—this is a total of 30,000 cow days or 300 head of cows for 100 days. This would be one of our better pastures which had good forage and water.

We run our cattle during the summer in fairly small herds. Our calf crop of over 90 percent for many years has shown the advantages of calving and breeding in these smaller-sized herds. We like to hold our herd numbers down to 225 to 250 head, even less with two-year-old heifers, as opposed to the old theory of unlimited numbers in large pastures.

The Warren Live Stock Company has been in business for over 70 years, originally as a partnership and since 1883 as a corporation. Our range is in better condition today than it has ever been. Surely such practical examples as this—of successful operation over many years—prove that ranches can be run by private interests without the interference of armchair theories whose sole capital investment is in their political job.

Water Whenever You Need It

Condensed from the New England Homestead

Paul W. Dempsey

EVERY grower who plants crops with a high acre value should have some means of applying water to insure the success of those crops. Many times a grower has been able to pay for the necessary equipment with the profits from one dry season.

Serious dry spells are likely to occur at any period during the season and in some years there may be several such spells. Even on muck land, where one would naturally expect sufficient moisture, growers have found it profitable to install irrigation systems.

To insure good crops every year—growers of small fruits, vegetables, potatoes, nursery stock and flowers should consider an irrigation system as necessary as a cultivator. "Ask the man who owns one"—you will find very few who have not found it a good investment.

Every grower will find his conditions different from every other grower so it is impossible to make many very definite recommendations. I suggest that you look around and see what growers have done who are farming under similar conditions to yours. You will find most such growers quite proud of their irrigation equipment and willing to give what-

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ever information you desire. After you have decided about what you want, get in touch with the salesmen. Notice that I said "*men*" for no one company has a corner on the best equipment. If you plan to use electricity you should ask your power company for help. Also find other sources of help through your county agent. Irrigation equipment is expensive and you should try to understand just what you should do before you do it. Don't expect to get this equipment all installed a few days after ordering —many growers keep putting this matter off until they are in the midst of a dry spell. These days there is no such thing as a hurry up job. Irrigation equipment is a lifetime investment and should have careful consideration before purchasing.

A good water supply is most important. There are several possibilities:

1. Nearby source just waiting to be tapped—such as stream, river or pond. Consider yourself lucky if there is such.

2. Nearby source requiring special preparation—such as a dam in a stream or an open pit in a swamp. Sometimes a large shovel can do the necessary job in a few days at comparatively low cost.

3. Community mains nearby. Here is the necessary pressure and water "on tap". What does it cost? Cost of pumping by electricity and gasoline is from 3 to 10 cents per 100 cubic feet. Pumps and motors cost from $100 to $500 and up. Metered water around Boston varies from 7½ to 15 cents per 100 cubic feet (750 gallons). This may be ideal for a small installation. How about the supply during a dry season? When separate fields are near improved roads with water mains, it may be possible to install separate meters at a saving in pipe.

4. Wells cost money to dig and pumping charges may be greater. However, many growers find them entirely satisfactory.

How much land must be covered at one time? If you have 6 acres of crops that might need water once a week you should have sufficient equipment to water an acre a day. One inch of water should be applied at a time or about 30,000 gallons per acre. The minimum amount of equipment to apply this water would be: Skinner type which applies about one inch in 8 hours would require enough to cover an acre all at once or 4 lines 200 feet long using 60 gallons per minute; rotary sprinkler type which can apply about one inch in 2 hours would require sufficient pipe to cover one quarter of an acre at one time or one line 200 feet long, using 250 gallons per minute.

The so-called "Skinner" System has been the most common method of applying water in New England. It consists of standard

galvanized pipe with small brass nozzles every 3 feet. The pipe is supported by posts 1 to 7 feet high or laid on the ground. Water power motors are available for turning the lines but most growers do this by hand.

The rotary sprinkler or lightweight portable pipe system is most popular now because of the ease of handling and its ability to put the water on faster. Revolving sprinklers of many sizes and types are available. These throw from 5 to 400 gallons per minute in a circle with a diameter of 40 to 400 feet. The pipe is available from 2 to 8 inches in diameter.

Green Roughage Pellets

Condensed from Nebraska Farmer

Jim Boan

THE alfalfa pellet was two inches long and a half inch thick. It looked like a stick of dark green candy. Wiley Miner watched the pellet crumble as he closed his hand.

"Feed buyers test pellets this way," he said. "If dehydrated pellets crumble they know livestock can digest it easily and get full value from the feed."

The Moray Processing Corporation in the little town of Verdon makes these pellets. The whole alfalfa plant is dehydrated and pelleted. That's what makes it different. The new industry is centered around a master stem crusher or stem splitter. This machine crushes and splits stems and stalks so that they can be dehydrated and pelleted.

Roland Owens and Mr. Miner own the Verdon industries.

Satisfactory experiments have been made in pelleting field corn in the roasting ear stage, sorghums, and citrus pulp. But by far the most work is done with alfalfa.

Mr. Miner and Mr. Owens used to be in the wholesale hay business. They bought quality hay, mostly for dairymen. "These feeders kept pressing us for a better quality hay, and it made us think," said Mr. Miner. "Finally we got the idea of a master stem crusher, and in 1936 we formed a company to develop the idea."

It wasn't easy sledding for the new company. When the stem crusher was made they applied for a patent and found that the theory had been developed by another

man. The difficulty had to be ironed out. The war was going on and supplies were short. Nevertheless in 1944 the Moray Processing Corporation completed building the present plant. They made some test runs and found that adjustments were needed in the stem crusher. It was June, 1947, before continuous alfalfa dehydrating and pelletizing operations began.

The Raymo Manufacturing Corporation bought a barn at the edge of Verdon for a place to build stem crushers. The crushing blades, something like hammers in a hammer mill, are made of heavy steel. The quality of the machines was tested last year when accidentally a log chain went into one and a sledge hammer went into another. Although both machines were damaged they are now in operation again. Last year the processing plant produced 1000 tons of one type of pelleted alfalfa.

Some of the alfalfa products made are: Pelleted sun-cured alfalfa, mostly from Colorado; pelleted sun-cured alfalfa mixed with different percentages of molasses; and dehydrated and pelleted Nebraska alfalfa, called Past-Ur-Like. Alfalfa for Past-Ur-Like is cut and chopped in the field and hauled directly to the plant where the finished product is made. The coarse-shredded alfalfa is pelleted just as it comes from the dryer after dehydration. Moray products range from $60 to $80 a ton and are in line with other alfalfa products.

By taking alfalfa directly from the field, losses from weather and storage are avoided. A check on an improperly cooled sample of pellets showed no carotene content drop in the first six months and only a 38 percent drop in the second six months. They have not been in operation long enough to run a six-months check on Past-Ur-Like.

Practical feeders have great enthusiasm about the new product. Many dairymen in the East herald whole-plant pellets as a new era in livestock feeding. Even inquiries have come from England.

"One thing we believe," says Mr. Miner, "is that alfalfa processing is a step toward an ever-normal granary for roughage."

Atomic Energy Aids Agriculture

Condensed from Farm Research

Michael Peech

Atomic energy may help farmers to get better results from liming soils, possibly at a lower cost.

The discoveries which led to the atom bomb may also lead to better use of fertilizer and lime in agriculture. With the development of the atom bomb a new method of producing radioactive isotopes was discovered. Although artificial radioactive isotopes were produced as long ago as 1934 in a "cyclotron," the cost of producing them was all but prohibitive. Now, the chain-reacting uranium pile (the atomic furnace at Oak Ridge, Tennessee) has not only greatly stepped up the production of artificial radioactive isotopes but has also cut down the cost.

Radioactive isotopes are atoms that have the same chemical nature as atoms of natural or normal elements, but the radioactive isotopes differ from the normal atoms in that they are unstable, and as a consequence emit energetic types of radiation similar to that from radium. This radiation can be readily detected by a suitable electrical measuring instrument, known as the Geiger counter. Because radioactive isotopes give off "tell-tale" radiation, the scientists use them as tracers in their experimental work. For this reason the radioactive isotopes are sometimes called radioactive tracers and indeed it is this feature that makes them exceedingly useful in agricultural research. Radioactive isotopes of many different plant-nutrient elements have now become available and are being distributed by the Atomic Energy Commission for use in agricultural research and other worthwhile applications.

Ithaca agronomists are using radioactive calcium in their studies on liming soils, in an effort to find out just how lime benefits plant growth on acid soils and what is the best method for liming soils. Many theories have been proposed to explain how lime benefits legumes and other crops that do not grow well on acid soils, and many factors are involved in the growth responses of different crops to application of lime on acid soils. The relative importance of the different beneficial effects of liming acid soils, however, has never been properly evaluated because

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of the inadequacy of the past experimental techniques. Some of the experiments now in progress at Ithaca would indicate that the poor growth of many crops on acid soils is not necessarily due to the low calcium supply of acid soils, and that the crop responses to lime cannot be simply attributed to the increased calcium supply in the soil after application of lime. Indeed, for some unknown reason, the plants are unable to take up calcium from acid soils even when well supplied with soluble calcium salts.

Thus the Ithaca agronomists are trying to evaluate the different beneficial effects of liming soils, particularly the direct nutritive effect of calcium in the applied lime, by using lime in which the calcium has been made radioactive. The radioactive lime in varying amounts is thoroughly mixed with the soil to different depths. In some experiments, it is simply drilled in with the seed. The plants are then grown on the limed soils, harvested, and the yield responses to lime are determined as usual. The plants are ashed, and are then analyzed for the total calcium content by the usual chemical methods. But here is where the new method takes over with the help of the Geiger counter, which can detect and measure accurately the radiations from the individual radioactive calcium atoms present in the plant ash—the calcium that *must* have come from the radioactive lime applied to the soil in the liming experiments. The ashes of the plants are placed in a well-shielded lead chamber next to the Geiger counter; it counts and automatically registers the radiations at rates as high as 20,000 counts per minute.

From such data the agronomists can calculate exactly how much of the total calcium in the plants was taken up from the applied lime and how much of it came from the original calcium supply in the soil.

Perhaps this information will help the farmers realize more profit from the approximately $100,000,000 spent in liming operations each year in the United States.

The Story of Man-Made Weather

Condensed from American Fruit Grower

Vincent J. Schaefer

SINCE the time that some of our ancestors first found that a rude shelter and a campfire afforded a degree of protection from snow, cold air, wind, rain and lightning, man has sought ways to overcome the discomforts of "bad" weather. Slowly, he has discovered ways to surround himself and his family with controlled "weather" in the form of warm homes, air-conditioned stores, heated water, well-lighted rooms, and hosts of other things which make life less rigorous.

While these conveniences tend to make us less dependent on the sort of weather doled out by Mother Nature, the farmer, in particular, has always been at the mercy of the weather. Ice storms, drought, torrential rains, lightning, high winds, floods, erosion, dust storms, hail, frost, and excessive heat or cold combine singly, or sometimes in rapid succession, to complicate and sometimes completely ruin the results of a season of hard work.

Considering these factors, it is little wonder that soon after man emerged from his primitive existence and started to recognize the uncertainties of weather, he tried to discover ways to manipulate the weather to better satisfy his needs. Long before recorded history, he learned that when rain failed to come it was sometimes possible to irrigate, and thus use precipitation, which occurred earlier in the season, to help mature his crops. He sometimes resorted to less direct methods which often led to a considerable abuse of logic and reason. Thus, the medicine man, the rainmaker, and similar types of individuals appeared on the scene, flourished while lucky, and then faded from the picture as less credulous critics raised pointed questions about their activities and the results. How then, with such a background of uncertainty, prejudice, skepticism and ambiguity, can we properly evaluate the past year's activity in the realm of rain and snow making?

There are several factors which make the present activities exciting, to say the least. For the first time, scientists from many different fields are combining forces in an attempt to wrest from the atmosphere the secrets that Nature, heretofore, has guarded jealously.

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Man is probing far into the stratosphere with rockets laden with all kinds of precise instruments; he is discovering, with sensitive radio, fascinating things about the ionized layers which probably have much to do with the weather patterns of the world. With radar he can now plot "contour" maps of precipitation areas in clouds. Supersensitive seismographs let him chart the movements of hurricanes many hundreds of miles away, and by means of elaborate flight programs, he has probed the structures of thunder storms and watched the shift from supercooled clouds to snow and rain areas by precise and quantitative seeding operations.

Astronomers, physicists, chemists, meteorologists, radio engineers, hydrologists, seismologists, mathematicians, and hosts of others are, today, using all sorts of instruments to unravel the mysteries of our planet and its weather.

In the last year we have acquired a better understanding of clouds and cloud systems. We have learned that profound changes can be produced wherever Nature permits unstabilities to develop. We have advanced our knowledge of some of the phenomena which are part of the natural weather cycle so that we are better able to evaluate results which follow artificial seeding activities. That a profound change can be induced in an unstable cloud system by proper seeding techniques is now well-established.

To illustrate one phase of cloud modification techniques which has been followed with a considerable degree of success during the last year, let us mention the use of dry ice. This is solid carbon dioxide, a common substance having a temperature of $-78.5°C$, available in most parts of the country, and costing less than five cents a pound.

To start with, at least a part of the cloud must consist of liquid water droplets colder than 0°C. Wherever such supercooled droplets exist, it is a simple matter to produce large numbers of ice crystals in that region. It can be shown quantitatively in the laboratory that a pellet of dry ice the size of a pea is capable of producing at least 10^{16} ice nuclei. Whether all, or only a minute fraction of these, grow to snow crystals when introduced into a cloud depends on such things as the available moisture, the convection in the air, the efficiency of dispersal of the nuclei, and similar factors. To emphasize the tremendous numbers of nuclei which are available when a dry ice pellet is introduced into a supercooled cloud, note that if each of the 10^{16} ice nuclei grew to the size of a small snow crystal, they would amount to 300,000 tons of snow!

If any appreciable precipitation

is to fall from a seeded cloud, a number of favorable conditions must be present. For example, unless the humidity of the air below the cloud is fairly high, the precipitation may evaporate before it reaches the ground. It is of even greater importance that there be a continuing supply of moisture flowing into the affected region to continue the precipitation, for there are only about 0.15 inches of condensed moisture in an average cloud which has a vertical thickness of a mile.

Much work must be done before more than local showers can be produced by man using dry ice or any other material in the clouds of the atmosphere. Unfortunately, when rain is needed to relieve a drought condition, there is often nothing but day after day of cloudless skies over the affected region. However, sometimes it should be possible to trigger off a considerable shower from a towering cumulus before the precipitation cycle develops by natural processes. It should be possible, at times, to initiate the development of a snow or rain storm at a specific location when nature permits the development of a large area of supercooled clouds.

The following is a list of some of the experiments conducted during the last two years which are representative of the general advances made in cloud modification:

November 13, 1946—Initial experiment by the author over Berkshires in Massachusetts, converting a four-mile supercooled stratocumulus cloud into snow flurries using six pounds of granulated dry ice.

November 21, 1946—Conversion by the author of supercooled ground fog to snow crystals by seeding with dry ice. Schenectady, New York.

December 20, 1946—Production of snow by R. Smith-Johannsen in supercooled orographic cloud on summit of Mt. Washington, New Hampshire. Seeding with liquid CO_2 from tower of Mt. Washington Observatory.

December 20, 1946—Production of extensive snow area by the author in supercooled stratus cloud by seeding in base of supercooled overcast with dry ice and liquid CO_2 in region north of Mohawk Valley in New York.

February 5, 1947—E. B. Kraus and P. Squires. Production of rain in stratocumulus by seeding supercooled cloud at 23,000 feet with dry ice and detection of effect by radar 100 miles east of Sydney, Australia.

February 6, 1947—Production of snow by R. E. Falconer and V. F. Clark in supercooled orographic cloud at 6,200 feet using silver iodide flare. Mt. Washington, New Hampshire.

April 4, 1947—Colonel E. S. Ellison and L. R. Richards. Pro-

duction of rain in supercooled stratus cloud at 10,000 feet in Oregon.

April 7, 1947—Personnel of Project CIRRUS. Joint Army-Navy-Air Forces-General Electric project produced 45-square-mile geometric hole in supercooled stratus cloud over Adirondack Mountains in New York to obtain quantitative information on effect of dry ice seeding methods.

July 16, 1947—A. Hoff and H. L. Mott. Production of rain from cumulus cloud near Phoenix, Arizona, by seeding cloud at 20,000 feet with dry ice.

September 23, 1947—Production of rain at 9,500 feet by L. B. Leopold and M. Halstead in above-freezing cumulus cloud using dry ice over island of Molokai in Hawaiian Islands. Results interpreted by Dr. Irving Langmuir as start of chain reaction in new precipitation theory advanced in paper delivered before the National Academy of Sciences, November 17, 1947.

October 13, 1947—Personnel of Project CIRRUS in dry ice seeding flight and cloud study of hurricane "King" 350 miles east of Jacksonville, Florida, at 25,000 feet.

September – October, 1947—Production of snow and rain by C. L. Chipman and G. G. Sampson in vicinity of Prosser, Washington, in series of flights.

October – November, 1947—Series of experimental flights over western Kansas by C. Barhydt and J. Berkeley, producing snow and rain areas.

Many other experiments might be listed, but it is believed that the above examples illustrate some of the significant advances in techniques and materials during the last year. The list indicates the widespread and active interest that has developed in the general subject. Many experiments have been carried out in other countries which have not yet been reported in sufficient detail to permit analysis.

What the future holds is not easy to predict. Caution must be exercised in analyzing experiments of this kind. It should be remembered that natural processes generally produce precipitation when suitable cloud systems occur. Much careful study of naturally occurring precipitation must be made to differentiate properly between natural and artificial effects that develop in the free atmosphere. Because of the vast areas involved, new observational techniques must be developed and mastered if a worthwhile evaluation is to be realized.

The elimination of hail storms, the modification of thunder storms, the removal of icing conditions in supercooled clouds, and the possible increase in precipitation under certain unstabilities of

the atmosphere seem to be some of the benefits that may result from the present activity in the field of experimental meteorology. This activity is rapidly spreading throughout this country and into many other parts of the world.

It is very likely that the next year or two will disclose the limitations of the present techniques involving the use of dry ice, silver iodine, water, or "wet" ice. As is always the case, however, when careful research is conducted, all sorts of unexpected occurrences will be observed, which if properly recognized, evaluated, and exploited will lead to newer techniques which will undoubtedly lead to a better understanding and quite likely a certain limited control of the weather.

Storing Grain in Small Bins

Condensed from Marketing Activities

E. R. Gross and H. H. Walkden

GRAIN can be stored almost indefinitely with little deterioration in farm-type bins—those that hold 1,000 to 3,000 bushels—if it is kept dry, cool, clean, and free of insects.

When the Government acquired large surpluses of grain under the Agricultural Adjustment Act, the State agricultural experiment stations of Illinois, Iowa, Kansas, and North Dakota and several units of the U. S. Department of Agriculture started cooperative investigations to determine the best ways to store grain in farm-type bins. The investigators had problems, particularly with shelled corn, that had never before arisen. But as a result of their efforts many millions of bushels of wheat and shelled corn were stored several years with a loss of less than 1 percent that could be attributed to deterioration while in storage.

One of the first things they learned was the importance of having the grain dry. The maximums in moisture content considered safe for the long-time storage of shelled corn and wheat are: Shelled corn, 13 percent; hard red spring wheat, 13 percent; soft red winter wheat, 12.5 percent; hard red winter wheat, 12 percent.

Lower average grain temperatures can be maintained by painting steel bins white or by shading

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them. Grain in wooden bins is less subject to extremely high temperatures at the walls. Temperatures of 135° F. were observed at the walls in unpainted steel bins at Hutchinson, Kans.

Dry, cool, clean grain discourages the development of insects. For the control of insect infestation, chief reliance must be placed on fumigation. Grain dust and broken kernels contribute to a favorable environment for insect development and make fumigation harder. Grain that contains large amounts of foreign material, such as weed seeds, husks, and stems, may deteriorate because of the higher moisture content of such materials.

The research men made many observations on the condition of grain stored in steel bins during the storage period and when the bins were emptied. The most serious damage to the grain was caused by water leaks at bolts joining wall and roof sheets, door jambs, ventilators, and such. Because of low foundations and poor drainage, some bin floors were submerged. If the floor or foundation extends laterally beyond the bin wall, drainage from the walls will be intercepted and is likely to enter and cause decay. Inadequate foundations led to settling so there was distortion of the bin and straining of the joints. In the northern sections wind-driven snow came through the cracks that resulted. Bins must have sufficient strength in foundations, floors, and walls to resist the pressure of the weight of the grain.

Making the bins leak-proof is largely the responsibility of the manufacturer, but farmers must consider the point when they buy and erect the bin. All joints between roof sections, wall sheets, and framing for openings require careful caulking at the time of construction. Bins already built can be improved by caulking. Bolts must be equipped with leak-proof lead washers applied under the head and drawn to uniform tension.

The floor should be elevated enough above normal grade so that water cannot collect at the floor-wall junction. Water from melting snow banked against the bin wall may enter at this point. Careful caulking there will minimize the hazard. Wall sheets must extend below the floor level to avoid a water table that will collect drainage from the walls.

Wooden bins provide good storage if they are kept tight. Single-wall bins are seldom tight enough to exclude moisture or retain fumigants satisfactorily. Bins that are not tight can be lined with heavy, reinforced, waterproofed paper, which must usually be replaced or repaired for each filling of the bin. Double-wall bins have proved to be superior to single-wall bins over a period of years

because they keep out moisture and retain fumigants better. During the investigations, many other materials were tested and were found to be satisfactory if they met the requirements of structural strength, durability, and exclusion of dampness.

Drying in steel bins with perforated walls or floors or both and wind cowls of either the pressure or suction type was satisfactory. But wall perforations admitted moisture during driving rains, and the grain at the walls spoiled. The successful use of perforated walls is limited to the drier high Plains region.

Wood, steel, and concrete are commonly used for permanent grain-bin floors. Recent tests of these materials in 18 types of construction showed that 3 general types are satisfactory: Any floor supported on joints with free circulation of air beneath; steel floors on a fill of either earth or gravel to raise the floor above the surrounding grade and provide drainage away from the bin; concrete floors when equipped with a positive moisture and vapor barrier.

Insects attacking stored grain are not active at temperatures below 40° F., and multiply rapidly only at temperatures above 70° F. Insects are not a serious factor in the northern part of the grain-growing region, because temperatures of the grain do not rise high enough during the summer to permit the rapid development of infestations. The higher average temperatures south of the forty-first parallel favor rapid development, and insect infestation becomes a major hazard.

In southern Kansas, 22 management practices were evaluated with respect to their effect on wheat and their efficiency in preventing damage from insect attack. With the exception of the untreated check bins, all the practices maintained the original commercial grade until the bins were emptied. Three were found to be satisfactory in controlling insect infestation: Fumigating twice annually, in August and October; fumigating annually in September; turning, cleaning, and fumigating annually in September. Steel bins with white walls and roofs maintained average grain temperatures about 6° F. lower than unpainted bins. The lower temperatures prevented the development of damaging insect infestation during the first 3 years but failed in the fourth.

For long-time storage the practice of fumigating in August and October and that of turning, cleaning, and fumigating in September were equally effective, but the added cost of turning and cleaning is not usually warranted. Fumigating in September has the advantage of reducing fumigation expense, but the rapid develop-

ment of insects in August and early September just before fumigating causes unnecessary damage to the grain and leaves it more susceptible to subsequent infestation.

Besides eating the grain, insects cause other damage. In the fall, moisture accumulates in the cooled grain on the surface as a result of the normal upward movement of air from the warmer grain below. Insects create both moisture and heat, and they cause hot spots when they are concentrated in large groups. Severe infestation accelerates the upward movement of moisture and causes crusted and moldy grain at the surface so that all grain may be contaminated when the bin is emptied.

Fumigation offers the best method of controlling insects attacking grain stored in farm-type bins. It is advisable to inspect stored wheat once a month during periods when the temperature of the wheat reaches or exceeds 70° F., and to fumigate it if found to contain one or more weevils or lesser grain borers, or 15 or more bran beetles per quart.

By fumigating in August and again late in September or October, insect infestation will be destroyed. The wheat will cool normally in the fall and winter, and will usually remain in good condition until mid-summer.

Inspection after severe storms is desirable. If leaks have developed wet grain should be removed, because migrating insects are attracted to high-moisture grain.

Shelled corn placed in long-time storage should be clean (that is, with less than 0.5 percent of cracked corn and foreign material). It is advisable to spray the surface grain with oil at the rate of 2 quarts to 1,000 bushels—an excellent preventive against insects that are likely to enter the bin during the summer. The oil should be a refined mineral oil of 100–200 seconds viscosity (Saybolt, 100° F.) and be free from objectionable odor. Corn should be inspected with the same frequency as recommended for wheat and fumigated when found to be infested at the rate of 1 weevil or 25 bran beetles per quart.

Oxygen Helps Them Hatch

Condensed from Western Farm Life

Maurice R. Haag

ANYONE who has ever climbed around on a mountain-top has found that the thin air cuts down on his activity. It now appears that this same factor has been responsible for the exasperating and puzzling inability of hatchery owners in the Intermountain Region to produce good chick and turkey hatches.

For many years, the hatchery industry in the Rocky Mountain states has been handicapped by poor egg hatches. That is why a recently completed study at Laramie, Wyoming, has aroused much interest among the poultry producers in this region. The study may not solve all the hatchery difficulties for this area, but it does give promise of improving egg hatchability to a point where local hatcheries can establish themselves more widely in the high altitude sections.

Thin air has an effect on hatching eggs, which, until last spring, has been recognized but not understood. Baby chick embryos and turkey embryos, inside the egg, are living organisms. Like all organisms, they need oxygen for growth. And while the egg is packed with everything else that the embryo needs, oxygen is the one thing the air must supply.

How the oxygen gets into the egg is an interesting story. At sea level and at altitudes close to sea level, where most domestic poultry originated, the air pressure is considerably greater than at higher elevations. This means that at sea level, the molecules of air, and thus of oxygen, are closer together and that the number of molecules of oxygen coming in contact with the shell of the incubating egg is greater than at higher elevations. Since during incubation a constant passing of oxygen into the egg and carbon dioxide out of the egg through the pores in the shell occurs, it naturally follows that at high elevations, where the molecules of air are farther apart, fewer molecules of oxygen are in contact with the shell of the egg. The higher the elevation, the more acute this shortage of oxygen becomes.

At 5,000 feet above sea level, it is so restricted that not enough oxygen gets to the growing embryo in the egg. The unhatched turkey poult, or chick, may struggle along

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for awhile, but as it grows and its need for oxygen gets greater, it suffers more and more, and finally dies.

Colorado, Wyoming and Utah, as well as some other mountain states, have large areas which are well above the 5,000-foot level. This altitude is apparently the critical one, so far as chick and turkey poult hatcheries are concerned but, some hatcheries at lower levels have also reported trouble, particularly with turkeys.

The discovery that oxygen will improve hatches at higher altitudes is the outcome of work by Lawrence Morris, former poultryman at the Wyoming experiment station at Laramie, but now with the Utah agricultural extension service at Logan. He had come up against the hatchery problem in his research work at the Wyoming station. Laramie is at a 7,200-foot altitude, and good hatches there are the exception rather than the rule. Morris, through his contacts with Wyoming poultry producers, was also well aware of the difficulties of commercial hatcheries in this field.

Morris, in studies, eventually concluded that atmospheric pressure might be the factor causing poor hatches. He thought at first of setting up a pressurized incubator, but rejected this theory in favor of injecting pure oxygen into the incubator instead.

Borden Ells, who joined the Wyoming staff at a later date, took over active supervision of the study, and early in 1947, he and Morris had their equipment ready for a test. The results, in general, follow:

Both chickens and turkeys were used in the experiment.

Two incubators were used. One incubator was so arranged that pure oxygen could be fed into it and the oxygen content of the air therein held at any desired level. In the other, no oxygen was added, and the incubator was operated in the usual manner as a control. In the oxygen-equipped incubator, the oxygen was kept at a high enough level so that the developing embryos in the eggs obtained approximately the amount of oxygen they would get at from 1,000 to 1,500 feet above sea level.

The most remarkable improvement was found in the turkey hatches. Here, the use of oxygen produced a 66.7 percent hatch of turkey poults. In the control incubator, the hatch was only 27.5 percent, typical of turkey hatches generally at this elevation. Of 68 eggs set in the control incubator, 10 were infertile, 31 had dead embryos, 11 were pipped, and only 16 hatched. Of 68 set in the oxygen incubator, 14 were infertile, 14 developed dead embryos, four were pipped, and 36 hatched.

Chick hatches showed a substantial improvement from the use of the oxygen, although the improvement was less marked than that in the turkey hatches. The hatchability of the chicken eggs was increased approximately 18 per cent through introducing more oxygen into the incubator. The chicks from the oxygen-hatched eggs were more vigorous, had longer down, and displayed less stickiness than the chicks hatched in normal air.

Another point involved the addition of oxygen during only part of the incubation period. This procedure improved the hatches, although to a lesser degree than when oxygen was kept in the incubator for the entire incubation period. Adding oxygen during the third week only was preferable to giving it during the first or second weeks only.

Several questions remain to be answered about the practicability of oxygen hatching. Will the cost of the oxygen be too high?

Probably not. In the experimental work, a $6.00 tank of oxygen was used on a 300-egg incubator. The tankful lasted about 10 days. In a larger incubator, say the 10,000 to 50,000 egg sizes in commercial hatcheries, the amount of oxygen needed per 100 eggs would drop. The problem involved is that of replacing the oxygen lost whenever doors are opened. More study is needed on this phase of work, and Maurice Meshew of the Wyoming experiment station is planning to undertake such a study during the coming season.

Another problem is the need for a gauge or instrument for measuring the amount of oxygen present in the incubator and for holding the oxygen at the right level. In the Wyoming experiment, a complicated and expensive piece of equipment was used, since it was the only thing available at the time. This equipment is too expensive for ordinary hatchery work. A cheap and efficient gauge of some sort remains to be developed.

If oxygen can be used for getting better chick and turkey hatches, it will mean cheaper chicks and turkey poults, and that more and better chicks can be hatched locally.

The ordinary hatch of turkeys may run, say, 40 percent. This is 40 poults out of 100 eggs. At a value of 80 cents a poult, the birds are worth $32.00. But if the oxygen improves a hatch as much as now seems likely, there will be a 60 percent, or even 75 percent hatch, with 60 poults worth $48.00. The oxygen cost needs to be charged against this, of course, but the hatcheryman would be in a position to pass along some savings to the buyers, both of chicks and poults.

This reduction in cost may en-

courage the starting of more local hatcheries and will help those already in existence in the mountain states. Shipped-in turkey poults and chicks suffer a higher mortality than those produced locally, simply because of the time in transit and the shipping hazards. Home-produced chicks and poults are preferable, if they can be produced economically, because it is possible to take them directly from the incubator to the brooder.

There is another advantage, too, in having local hatcheries in mountain state communities. They are an important factor in a well-established poultry industry. The hatchery owner is interested in the production of a good supply of eggs and poultry products locally, since his money is invested in that production. He is an important factor in encouraging such production in his community.

Many mountain state cities are poultry-deficient areas. Eggs must be shipped in; poultry must also be brought in to feed the cities. Consumers in these towns are well aware of this situation, due to the higher prices they pay. There is an opportunity for local poultrymen around these towns to step in and to meet the local market demands. If the oxygen-hatching is the important factor that it now seems to be, it may be the key to a better supply of eggs and poultry throughout the west.

Dries Wilted Hay

Power equipment has taken nearly all the hand work out of haymaking for George Van Brimmer, Delaware county, Ohio. A metal finisher is used to complete drying wilted hay that is picked up and chopped in the field. A 5-horse motor blower removes excess moisture which may be as high as 50 per cent when the hay is put up.

Van Brimmer's storage is a cylindrical building 18 by 36 feet with an 8-foot dome. It will hold 40 to 50 tons, depending on how fine the hay is chopped. A ventilating tube thru the center is 4 feet square. It serves as a pressure chamber when the blower is used for drying.

Hay is cut about 9 o'clock in the morning and picked up by the field cutter about 2. It is well wilted but not dry enough to keep. Van Brimmer uses unheated air to complete the curing. Last year he filled the finisher twice and fed the hay to lambs and cattle.

—Capper's Farmer

Root Rot of Sweet Clover

Condensed from Better Crops with Plant Food

Dr. W. A. Albrecht and A. W. Klemme
University of Missouri

Root rot was prevalent in Missouri on numerous fields of second-year sweet clover during the cool, wet springs of 1946 and 1947. This "disease" was also observed on some of the sweet clover plots under fertility control in the four-year rotation of corn, oats, wheat, and sweet clover on the South Farm of the Missouri Experiment Station. Other adjacent plots on the Farm made normal growth and were apparently not infected.

Various investigators have reported that different plants growing on potassium-deficient soils are distinctly susceptible to root rot. Ginsburg reported that soybeans suffering a potash deficiency develop very few lateral roots and those are only near the root base. These roots decay easily. According to Eckstein, Bruno, and Turrentine potassium deficiency has a greater influence on the root development of biennial and perennial plants than on annuals.

Close observations were made in 1947 of the sweet clover on the plots at the Missouri Agricultural Experiment Station in order to ascertain whether there was any correlation between the levels of the soil fertility and the susceptibility of the sweet clover to this condition often spoken of as the "disease" of root rot. An attempt was also made to determine the effects of the "disease" on the growth of the plant and on the production of nitrogen within the crop.

The plots on the South Farm of the University of Missouri where the sweet clover was studied have been in the above rotation since 1938. The soil is a Putnam silt loam, typical of the clay-pan soils of Northeast Missouri where the "disease" was reported most prevalent.

A highly pure calcium carbonate limestone of ten-mesh, mill-run fineness had been applied to all plots at the rate of two tons per acre. On other plots additional treatments of phosphate alone or this in combination with potash had been made. The plots and the soil treatments used in these more careful observations and study were as follows:

Plot I—Limestone—2 tons each eight years.

Plot II—Limestone—2 tons

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each eight years plus 425 pounds of 20 percent superphosphate in each rotation.

Plot III—Limestone—2 tons each eight years plus 425 pounds of 0–20–20 in each rotation.

The phosphate and the phosphate with the potash were applied as follows: 150 pounds in the row with the corn; 150 pounds drilled with the wheat, and 125 pounds drilled with oats. All crop residues were left on the land.

It was easily observed that the sweet clover on the plots receiving only limestone was badly infested with root rot. Only the roots near the surface of the soil were alive. The others were dead and had partially or even fully decomposed. The plants growing on the plots which received both limestone and superphosphate were more deeply rooted. They had much more top growth than those growing on the plots receiving limestone alone. Those growing on the plot receiving lime and both phosphate and potash had more root growth and much more top growth. The differences in weights of plant parts, in nitrogen content, and in the root rot are shown in Table I. The plants growing where only limestone was used could be pulled up by hand. The plants growing on the other plots were deeply rooted and could only be removed with the help of a tile spade.

Fractional samples of both roots and tops were harvested when in full bloom, air-dried, weighed, and the nitrogen content determined. These data are included with Table I.

The yield of air-dry roots harvested from the plots receiving limestone and phosphate exceeded that where limestone alone was used by 1,356 pounds or 65.5 percent. Where both phosphate and potash were used along with the limestone, the harvest of roots exceeded that from where limestone alone was used by 1,527 pounds or over 75.8 percent. Where limestone and phosphate were used, the yield of air-dry tops exceeded that where limestone alone was used by 2,730 pounds or 95.3 percent. Where limestone, phosphate, and potash were used, the yield of air-dry tops exceeded that over limestone alone by 4,706 pounds or 164.3 percent. In total growth of roots and tops where limestone and phosphate were both used, the yield of air-dry material was 4,086 more pounds or 83.3 percent higher than where limestone alone was used. The yield of roots and tops where limestone, phosphate, and potash were used was 6,278 more pounds or 127.3 percent higher than where limestone alone was used.

The total nitrogen in the tops and roots combined increased over 100 percent as a result of the addition of phosphate and about 200

percent as a consequence of the addition of both phosphate and potash.

The root rot infection varied from severe where limestone was used, to moderate where limestone and phosphate were used, to slight where limestone, phosphate, and potash were used.

The increased growth of roots and tops, and the larger amount of total nitrogen produced on the plots that received lime plus phosphate, and lime plus phosphate and potash, indicate that the additions to the soil of these inorganic plant nutrients reduced the susceptibility of the sweet clover to the root rot "disease."

These facts raise the question whether the root rot is a primary matter or whether it is one secondary to the deficiency of plant nutrients. There is the strong suggestion from these observations that the trouble of such a weakened root system is merely a consequence of the insufficient fertility and a condition to be remedied, not by an attempt to exterminate the micro-organism attacking the roots, but by feeding the plant more potash in a more fertile soil by which the plant roots are made non-susceptible to the root rot. Are we not about ready to say that the increasing incidence of what we call "disease" is the result of the decreasing fertility supply in our soils?

TABLE I.—HAY YIELDS, TOTAL NITROGEN, AND ROOT ROT OF SWEET CLOVER AS AFFECTED BY SOIL TREATMENTS

Treatments	Pounds Per Acre				Root Rot
	Roots	Tops	Total Plant	Nitrogen	
Limestone	2,072	2,864	4,936	80.0	Severe
Lime and Phosphate	3,428	5,594	9,022	162.0	Moderate
Increase over Limestone	1,356	2,730	4,086	82.0	.....
Lime, Phosphate and Potash	3,644	7,570	11,214	240.4	Slight
Increase over Limestone	1,572	4,706	6,278	160.4	.....

Plant Spacing Affects Tomato Yields

Condensed from the California Farmer

J. W. Hamilton

DOES the scientific spacing of tomato plants in rows have any bearing on production? Two Yolo county experts are going into their third year of experimentation on the subject. They are Dr. P. A. Minges, extension specialist in truck crops for the College of Agriculture at Davis, and Dave Holmberg, an assistant Yolo county farm advisor.

They predict that if future experiments bear out their preliminary findings, the matter of spacing plants may have an important bearing toward developing heavier yields earlier in the season.

Yolo county growers, who planted 22,000 acres to tomatoes in 1947 and lost a portion of their crops because of early unseasonal fall weather, are very much interested in the experiments.

Heavier yields early in the season would enable the growers to get more tonnage harvested before the rains and frost.

Minges and Holmberg point out that the experiments have not yet been concluded and no definite observations can be drawn. But the figures speak for themselves. Preliminary tests reveal that tomatoes planted in rows six feet apart and with plants spaced at intervals of from 18 to 24 inches, produce more heavily at the first picking than did the plants set at greater distances.

The experiments began in 1946, on the Harlan-Dumars ranch near Woodland. Four different spacings were used in rows six feet apart. The plants were set out at 2, 3, 4 and 6 feet. The plots were harvested three times during the season, August 28, September 17, and October 10.

The average production per acre for each picking was as follows:

Spaced 2 feet: 4.7 tons, 13.9 tons, 8.2 tons. Total, 26.7 tons.

Spaced 3 feet: 3.4 tons, 10.5 tons, 11.9 tons. Total, 25.8 tons.

Spaced 4 feet: 4 tons, 10.6 tons, 11.3 tons. Total, 25.6 tons.

Spaced 6 feet: 2.6 tons, 6.1 tons, 11.5 tons. Total, 20.2 tons.

The following year Minges and Holmberg ran two more tests.

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Los Angeles, California, April 10, 1948

Again on the Harlan-Dumars ranch transplanted tomatoes were used, and on the R. E. Carden ranch, also in the Woodland district, they experimented with field-seeded plants. They cut down the spacing of the transplants and the four pickings on September 16, October 2, October 18, and October 28 produced these results:

Spaced 18 inches: 8 tons, 11.6 tons, 7.4 tons, 2.8 tons. Total, 29.8 tons.

Spaced 3 feet: 6.6 tons, 9.2 tons, 6.3 tons, 2.7 tons. Total, 24.8 tons.

Spaced 6 feet: 4.4 tons, 6.8 tons, 5.3 tons, 1.4 tons. Total, 17.9 tons.

The three picks in the field-seeded plots showed the following:

Spaced 12 inches: 5.5 tons, 16.5 tons, 8 tons. Total, 30 tons.

Spaced 24 inches: 5 tons, 15 tons, 10 tons. Total, 30 tons.

Spaced 30 inches: 4 tons, 11 tons, 10 tons. Total, 25 tons.

Spaced 36 inches: 4 tons, 10 tons, 8 tons. Total, 22 tons.

Based on a two-year preliminary experiment, the experts have reached these conclusions:

"The use of close spacings in tomatoes may be of considerable economic importance in years where early rains may cause loss from rot and mould. This would also apply to years of early fall frost where loss occurs before all of the crops are in.

"Higher early yields from closer spacings would tend to reduce crop losses. Where transplanted tomatoes are grown, the extra cost of plants and labor may not compensate for the increase in early yield.

"However, where field-seeded tomatoes are grown, extra plants left in the field would not be much of a cost factor. Tomatoes should be well fertilized and watered in order to maintain plant growth if close spacings were used.

"Since the trials conducted so far have been made only on a limited scale, further information is needed before definite conclusions can be drawn. Growers who are interested in close spacing should try it out on a very small scale and find out for themselves whether it has merit."

Minges and Holmberg are preparing to engage in further experimentation this year. Inasmuch as drouth conditions prevail, they are anxious to determine the results of spacings during a dry season.

Large Scale Composting

Condensed from Organic Gardening

Dr. Ehrenfried E. Pfeiffer

THE largest compost heap of which I have heard contained several thousand tons of material, mainly organic wastes. A compost heap on a diversified or dairy farm can very well be as large as the manure heap deriving from the total production of the livestock on the same farm. About 200 tons of manure are produced on a hundred acre farm carrying 20 head of milking cows. On the same farm of which we speak, the farmer had built a compost heap 180 feet long, containing about 150 tons of compost. This farmer diligently collected everything organic which could be turned into humus.

The question has frequently been raised, "How is it possible to collect sufficient amounts of organic material?" And the objection has been made that all these composting procedures would take too much time and would not pay. Again, in talking with people, and in correspondence, we often encounter the opinion that composting is all right for the small gardener but that it does not fit into the large scale operations of a big commercial farm. In other words, it cannot be done economically and practically by the big fellow.

We have heard the formula "it cannot be done" so frequently that it has become an incentive to us to do it.

There are two types of large scale composting. The one exists on large farms or truck gardens and is part of the entire fertilizing program. The other type is more or less independent of farming but is part of the disposal program of city waste, slaughterhouse waste, industrial waste from wool, cotton, sugar factories, and other "digestible" materials (not including the harmful outpourings of the chemical industry), sewage disposal, lumber wastes, sawdust, etc. The composting of all of this second group of materials on a large scale is a commercial proposition in itself and will be treated separately.

On the basis of prewar price levels, it was officially estimated that the manuring value of plain farmyard manure (not considering any treatment) averaged about $2.50 per ton over the United States. This is not the sales value, which varies considerably, of

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course, according to local conditions and handling. It refers only to the value of the fertilizing ingredients, of N, P, K, lime, organic matter, etc.

Compost that is made from any other organic material besides manure has a somewhat lower fertilizing value per ton, about 70% of that of rich cow manure, for it is "diluted" with earth. This is valued, accordingly, at $1.60 to $1.70 per ton (again at prewar price levels). If I can produce compost for that much, fine; then it is worth that much to me. If somebody has to buy manure at $5 per ton and can substitute compost for part of it then the compost is worth 70% of the price he has to pay for the manure. This is the way it appears to the farmer who produces manure and compost on his own place. We know that in farm cost calculations the price of manure is set much lower. This is quite correct for the books. Should the farmer have to buy the equivalent of the manure in minerals the price would be near our standard figure as quoted.

In other words, if we could make a heap for $1.60 to $1.70 per ton it would pay to do it. Today (1948) we may very well double this price and could say that even at a cost of $3.20 to $3.40 per ton it would still pay.

The writer has kept detailed records of time, machines and wages involved in collecting material, digging the bases for the heaps, layering, covering with earth, watering, etc. One of the most expensive he has ever observed, cost $3.50 per ton. The average was $1.40 per ton and in some cases the expenses dropped below the dollar mark. These figures were taken from actual practice and farm records. It is only a question of good management, the use of time saving devices, skillful handling in order to keep the production costs low. The compost manager can apply his imagination and ingenuity fully here to improve the techniques. Surely there are many more machines to come which can facilitate the business. We have intentionally given this calculation a rough deal by not including the *humus* value of the final compost. If we add this the value may easily be doubled.

Now we come to the second point of large scale composting operations. Where do we get the material? One-third of the entire heap, in volume, should consist of earth which is used for interlayering and covering. Two-thirds consists of organic wastes. On a farm we find: chaff, old, spoiled hay and straw, dust from the granary floor and the bottom of the hay mow, scrapings from the barnyard, the yard and road scrapings (the latter are very rich). There are also the scrapings from ditches, hedge-row clippings, and the

leaves in fall—he who burns his leaves is as foolish as though he kindled his fireplace with dollar bills. Then too, there is any amount of garbage and weeds, and upon a thorough search one discovers still more resources: a pond cleaning once in awhile, a spring cleaning; chicken, pigeon, turkey, rabbit, dog and pig manures are best used in compost heaps. Yes, let us not forget the dust bag of the vacuum cleaner. The collection of these materials is made easy nowadays with mowing machines, mechanical manure loaders, dump wagons and trucks. Weeds can be mown and raked, straw too, after combining. Leaves can also be raked into large piles and then be picked up with the loader.

As stated above, on a 100-acre farm, about 150 tons per year of compost have been collected in this way. Additional sources would be green crops grown for that purpose or cover crops, f. i. in orchards. Then the farmer who grows beets, mangels or turnips has the tops of these plants for composting. Once the thrifty sense of the collector has been awakened many more resources will be discovered. It is merely a question of skillful planning and organization to save time in collecting. However, there are rainy days when one cannot work on the fields.

In starting a large heap it is best to first plough or scrape the area and then remove the earth to the desired depth with the manure loader. We have been very successful in digging a trench two feet deep and as wide as we desired with the manure loader. The earth can be heaped on the side and used for covering and interlayering, which can also be done with the loader. For digging you can use the bucket on the loader or you can scrape the dirt aside with the scraper blade. You can ride with a truck or wagon over the heap the long way and drop the material, if you leave a ramp at both ends and make the heap wide enough (12 feet f. i.). The watering can be done with a perforated pipe on top of the finished heap so that you need only to turn the faucet. When irrigation is available one can lead the irrigation ditch right to the compost trench and let the water soak in from below. The loading of the finished material is again done with the loader and spread with the manure spreader, which is possible when the material is well broken down.

Besides the material available on the farm there might be a chance of obtaining wool dust, tobacco dust, milling dust, slaughterhouse refuse, garbage, sewage, sludge, etc. Paper waste is best burned up and the ashes used (these are rich in potassium).

One farmer in Florida used the water hyacinths from the clearing

of creeks and stagnant water channels. Another gathered the waste from a sugar factory. Others pick up pea vines and other refuse from canneries (very easily picked up when products are delivered and the waste material taken home on the return trip). Many materials of this kind can be had for the "taking." An excellent listing of compost materials appears in the "Manual of Organic Materials," The Gardeners' Book Club, Series 3, Number 1, published by Organic Gardening, Emmaus, Pa., 1947.

Any farm, large or small, needs compost. If for nothing else, at least for the top dressing of pasture and hayfields. Cows do not like to eat the lush grass which grows on their own droppings nor do they like to graze freshly manured grass or eat freshly manured hay. Here compost is in its proper place. It is a supplement for the fields too, when there is not enough manure. We apply it at the rate of 6 to 10 tons per acre.

The turning of compost heaps is a costly procedure. In small and medium sized heaps is can be avoided by building the heaps in layers and controlling the moisture content. In very large heaps we can distinguish two distinct zones of fermentation: the outer layer more or less aerobic, the core anaerobic. The outer layer enriches with nitrogen, the inner layer may lose nitrogen. In the case of such large heaps, turning is advisable, perhaps after two to three months. It can be done with a mechanical manure loader by preparing two trenches in advance with an interspace wide enough for the passage of a truck, tractor or wagon. The loader can then swivel the compost from one bed to the other. A manure conveyor as used by mushroom people can be used too.

Any of the above mentioned industrial wastes, garbage disposal and peat can be turned into compost. Such enterprises will have large heaps. It is important that these heaps do not grow beyond certain limits, preferably not over 8 feet high and 20 feet wide, unless there is a possibility of mechanical turning with a snow removal machine for example, bull dozer or some kind of mechanical digger. Again one would use "half" trenches, about two feet deep and pile the material up to 6 feet above the ground. Watering is important. One of the first commercial composting enterprises was started fifteen years ago by M. Toussaint, at that time director of the Department of Hygiene of the City of Strassburg (France). The garbage of that city was collected in trucks. The householders were advised to keep two garbage pails, one for paper, broken chinaware, glass, tin, iron, i. e., all inorganic material and one for organic material. This enables one to avoid sorting the material

at the dump, otherwise garbage would have to be sorted. Finally it is necessary and pays well to pass the garbage through a shredder. Shredded material will rot more quickly, thus saving composting space and permitting a speedier turnover. Strassburg is surrounded by many farming communities and had an extensive streetcar system, including the villages. Street-boxcars transported the garbage to the compost yard and returned to the villages with the complete compost. Even cooking pots there disintegrated within a year in the pile.

The dumping places for compost manufacturing should have access to good surface soil since the composting process is more successful if topsoil is added. However, for reasons of economy, such places are usually located on waste land, gravel pits, etc. In the latter event, it is best to leave the bottom layer of the old compost heap as a "starter" for a new heap. A permanent system of irrigation can be installed. In turning heaps a rotation can be introduced so that fresh garbage and waste is interlayered with half rotted material (i.e. from the heap to be turned the first time). This procedure serves to inoculate the new heap with bacteria and will speed up the fermentation considerably. A second turning of the heap will secure thorough mixing and produce the final product.

In commercial composting the speeding up of the processes is essential. Here we deal with thousands of tons of material which require a large area. The quicker the turnover the less surface is needed. If the fermentation takes six months, for instance, instead of two months, three times as much material has to be piled up. It is here that turning machines pay very well, because, as already stated, turning results in aeration and a speeding up of the fermentation.

The writer could even imagine a system with transportable moving belts as they are used for the transportation of mining products. The arriving material would be shredded, dropped on a conveyor belt, transported to a particular heap or trench and deposited there. For turning, or layering, it would be loaded on the belt again with a loader and dropped on the new location.

A large town could thus use all garbage and sewage sludge and get all the necessary compost for its lawns, parks and gardens. Unless careful experiments have proved that the sewage sludge from sewage disposal plants is harmless as to bacteria, virus infections, etc. we do not advise sewage compost for vegetable production. But it can be used for lawns, flowers, shrubs, parks, pastures, cotton, i. e. for any crop

which does not have a direct connection with human consumption.

An increasing compost and organic matter consciousness on the part of the people as a whole would help toward the establishment of such economically valuable arrangements.

Let us now describe the procedures on a medium sized farm, of perhaps 200 to 300 acres. The ideal treatment of manure is, of course, accomplished by using a loafing barn, or as it is sometimes called a deep stall. In this barn the manure remains, litter is added every so often, and the cattle gradually rise higher and higher on the manure. I saw such a barn in late winter, many years ago in Scotland, where the cattle almost touched the ceiling with their backbones, having about 6 feet of manure and litter under them. This mixture of litter, manure and liquid manure keeps in the very best condition. It is interesting to know that recently the New York Association for Grade A Raw Milk has recommended the loafing barn as the ideal and most sanitary way to keep dairy cattle. In fact, the writer has tested the principle of a loafing barn several times for heifers and calves here in this country and has found that the animals keep much cleaner than they would in stanchions. This manure has a spongy, moist consistency, does not lose nitrogen, and can be brought out at once in spring. In general, a large loafing barn, with from 20 to 40 head, needs to be cleaned twice a year. The manure can be brought out with the manure loader and manure wagon to the very field where it is to be applied. There it can either be spread directly and ploughed under or it can be stored up until used. The storage, of course, is the process which we call the composting of manure. The manure piles are built up about 12 feet wide, 4 to 5 feet high and as long as you wish. It is wise to cover them until the time for ploughing is at hand, then the manure is loaded directly from the heaps and spread out. It is best to distribute the manure heaps along the edges of the fields in such a way that one has the fewest idle runs with the manure spreader. This is something which can be worked out on paper and adjusted in practice. Every farmer knows about how fast he can go with his manure spreader and can adjust himself accordingly.

The biodynamic method recommends the making of a compost heap using manure separately in heaps and also using green matter alone exclusively in other heaps. They do not follow Sir Albert Howard's Indore process.

With a stanchion set-up, the manure has to be brought out from the gutters daily. It is piled up in the same way, spacing the heaps along the edges of the vari-

ous fields where it is to be applied later. We make a distinction between compost and manure. What has been described is the process of composting the manure. Under compost, the writer includes all organic matter, other than manures, which is piled up in compost heaps as described.

On a 200 to 300 acre farm there is a very large amount of compost material which can be collected. We have already mentioned how much waste, scrapings and diggings are available. In practice, we feel that manure and composted manure is best applied to crops which exhaust the soil, that is, corn, potatoes, onions, beets or any other heavy feeder. Compost is a material which is better applied to hayfields and pastures. The compost heaps, therefore, will be built up along the margins of the hayfields and pastures. On pastures, they have to be protected against the cattle so that they are not trampled down. A barbed wire fence, or snow fences are the handiest types for this purpose.

When we speak of manure we mean either fresh manure or composted manure. Compost is the material which is collected on the farm and fermented, but without the addition of manure, that is, it is purely organic and vegetable matter of any and all kinds mixed with earth. Fresh, untreated manure, as it is usually taken out on the farm, loses most of its nitrogen even before it is ploughed under. This manure should be applied, for heavy feeding crops, at the rate of 12 to 15 tons per acre, to show any result at all. A composted manure which is very well-rotted, odorless, and of a nice brown color, crumbly in structure, can be applied at the rate of 8 to 10 tons per acre. Compost material, consisting of organic matter without manure, is usually not adequate for heavy feeders. It is more effective when used as a top dressing on pastures and clover fields as described above. Of this material we usually apply 6 to 8 tons per acre to hayfields, 8 to 10 tons on other crops. To give a picture of how these amounts appear when spread on a field, we many mention that in the case of raw, bulky manure, a cover so that you do not see the ground, or only barely see it, corresponds to 15 tons per acre. A spotted covering corresponds to 10 tons per acre. Of the composted manure, a thin covering corresponds to 10 tons per acre, a very spotted covering, with 6 to 8 tons per acre. Of well-rotted compost, a spotted covering corresponds to about 8 tons per acre.

There is one difficulty we encounter in practice, in regard to the spreading of manures, and that is the manure spreader itself. A very crumbly, fine material does

not spread well with the manure spreader. These machines are designed for moderately long material. Very long, bulky and strawy material, of course, make difficulties too. A very fine, earthy compost usually does not work well at all in a manure spreader. There is an urgent need to construct adequate machines to make compost spreading easier. At present, the main objections to composting methods are the time which is required for hauling and spreading and the difficulties of spreading a fine material. These things are very simple in a garden, there you can spread it by hand, but on a large farm we have to use mechanical equipment.

Up to the present, the farm machine industry has paid much too little attention to composting and manuring problems and we are sure that within a few years very practical machines could be constructed and sold at a fair price so that every farmer could afford them.

Hotbeds—Small Grower Doesn't Need Them

For a professional or an advanced amateur, or even a hobbyist there is certainly no substitute for a hotbed. The average gardener, however, may find very satisfying results by installing a soil cable in the open ground. This is what we have been doing for the last two years.

A single loop of the cable is buried about one-inch deep and four inches apart. A row of seeds is planted down the center of the row between the two cables and two more rows of seed are planted four inches on each side of the center row. This type of operation is very satisfactory with hardy plants such as members of the cabbage family. Tender plants such as tomatoes and peppers will break through the ground in a hurry because of the warm soil, but growth will then stop if the weather is cold unless some kind of protection is given.

This practice is successful as there are several weeks in the spring when there is little likelihood of frost damage but when the ground has not warmed sufficiently for good seed germination and root growth. Be sure to select a sheltered location.

—T. C. RUSSELL, Chicago.

—*New Jersey Farm and Garden*

Calming the Waters of the Coosa

Condensed from Soil Conservation

John McKinney

"I saw chickens riding high on broken houses. Bobbing along on the swirling flood were trees, fence posts, bridge timbers. People were trying to pull drowned automobiles out of water that obscured the streets. I saw farmers' faces as they watched their rich bottomlands go under."

Thus goes the eye-witness account of Harry Veatch who for 8 years has seen again and again the disastrous effects of floods in those fertile valleys that nestle between the hills of northwest Georgia.

"If the water goes off by nightfall, she won't sour," one stout-hearted farmer predicted for his milk-stage corn. But sunset came, and murky water continued to rise, quietly souring the corn meant for cornmeal, for hogs, for cash: shoes, groceries, medicine, education; nullifying investments in seed, labor, equipment; destroying some of the best land.

On rich lowlands grass and clovers grew lush, even in hot, dry July and August. Here cows could graze and grow fat. But floods came. Cattle drowned or were stranded. Farmers went in boats to feed them.

"I saw hundreds of tons of soil carried by," Veatch declared. He had worked as district conservationist for the Soil Conservation Service at Rome, Ga., a city set where the Rivers Etowah and Oostanaula form the Coosa, which flows into the Alabama, then into the Mobile, and finally into the Gulf.

Last year the Coosa River watershed above Rome was authorized by Congress as 1 of the 11 in the United States for Federal participation by the Department of Agriculture in establishing works of improvement to retard waterflow and prevent erosion in the interest of flood control. Technicians of the U. S. Department of Agriculture started at flood-ravaged Rome and trailed upstream to streamlets and gully heads, through red mud, to tops of bleeding hills where raindrops spattered naked soil on the watershed rim. "Here," they agreed, "is where the problem begins."

The Soil Conservation Service selected Veatch to prepare flood control work plans beginning in

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the Noonday Creek sub-watershed, a critical contributor to the flood and sediment problem of the Coosa River watershed.

Near the mouth of Noonday Creek lives an oldtimer of 80 years. "When I was a boy I had to swing down into Noonday on a grapevine when I went washin', but now, if I were younger, I could jump in without hurtin' myself."

On the Noonday Creek watershed lives Mrs. Clara Anneberg, owner-occupant of the pre-Civil War Kirkpatrick Mill site. Mrs. Anneberg told us the mill had ground corn "for over a hundred years." We saw a silted reservoir growing marshreeds and alderbushes.

Along Noonday Creek we observed once-beautiful farming bottoms abandoned to bushes. Leaving their potentially best lands, the farmers had taken to the red hills where they were trying to eke out an existence on eroded slopes from which top soil had mostly washed downstream.

They pointed out that streams filled with debris made it impossible for channels to carry the run-off from even light downpours. Some channels had filled completely, creating swamps. Soil Conservation Service engineers estimate that Noonday Creek is filling up at a rate of 3 inches a year.

In 1919 farmers in this watershed spent $41,000 to dredge and straighten 10 miles of channel. The cleaned channel has silted back, and then some.

We saw fertile loam sandwiched like cake-filling between original clay and sterile sand or stony wash. Standing on the wash, Farmer Clarence Kurtz observed, "When we moved here 39 years ago we could hardly climb down the creek banks but now the water overflows and gets into the barn."

Too often in Noonday Creek watershed we were ordered to stop by signs lettered: "Road closed—Bridge out."

Looking downstream, you get a view of Noonday Creek bottomland farming, more and more hazardous as one travels past many hundreds of acres of once-fine lands along the several hundred miles of meandering stream.

All along this route, the stream collects it toll. City people suffer along with farmers.

After essential surveys had been completed on the Noonday Creek watershed, a meeting was called by the Coosa Intra-Basin Committee of District Supervisors, made up of one supervisor from each of the four soil conservation districts involved and a fifth member at large. Attending also, were farmers, technicians of the Soil Conservation Service, county agents, foresters, county road commissioners, state highway representatives, and others.

In the end, a cooperative flood

control plan was worked out for the 32,000 acres in the Noonday Creek watershed with the follow-objectives:

(1) Conversion to forest of 5,-960 acres of severely eroded land now in crops, in pasture or idle.

(2) Establishment of pasture or perennials on 5,825 acres of land now in cultivation or idle.

(3) Clearing of 550 forest acres not subject to erosion, for clean-tilled crops.

(4) Stabilization of gullies and galled areas on 2,000 acres.

(5) Stabilization of cuts, fills, shoulders, and ditches on 40 miles of roads.

(6) Terracing, establishment of water-disposal systems, and installation of improved rotations on 4,200 acres.

(7) Improvement and maintenance of 1,200 acres of existing pastures.

(8) Snagging, bank clearing and stabilization of 20 miles of stream channel.

(9) Construction of small structures for regulating flood discharge where justified.

"Cultivation has moved back into the hills," says A. S. Booth, an SCS engineer. Several acres now are needed to grow what formerly grew on one acre of rich bottomland. The objective of the watershed improvement work is to reduce the damages from floods so that more use can again be made of the fertile bottomlands.

Agronomist John Brown recommends the use of kudzu with which to stabilize the miles of raw banks and adjoining gullies.

Forester Ellis F. Boyd figures that much of the area set aside for woodland will reseed naturally.

Coosa leaders are urging farmers to cooperate because of the direct benefits resulting to the land. They point to the value of improved bottom lands and the advantages of treating road banks, gullies, galled areas, and stream banks to reduce flood damage in the future.

Sweet Gum from the Sweetgum

Condensed from American Forests

Charles R. Ross

SWEETGUM (red gum to the lumberman) is one of the most common hardwoods of the South. Few if any trees have ever matched its remarkable climb in market value. It is a wood that often rivals walnut and mahogany, though not so readily recognized, for gum is capable of versatility in appearance.

The reputation, however, is maintained by limited numbers of a species comprising nearly 10 percent of the timber stand in a half dozen states. "Those gums—what can a feller do with 'em?" asks the farmer surveying the gum sprouts springing up, hydra-like, in his pastures and cutover woods. The sawmiller can't be counted upon to take the rough, sappy gums when he cuts the farm timber, even though the war market lowered his sights considerably. Great numbers of sweetgums are too limby or crooked for the present timber markets.

Clarke County, tucked into a big V formed by the junction of the Alabama and Tombigbee rivers in Alabama, might be termed the hub of the gum tree universe at the present time. Gently rolling, with well watered bottomlands everywhere, it approximates the ideal for sweetgum growth. Gums are there in great abundance. But enterprising Clarke farmers are no longer scornful of the legions of lower grade gums scattered over their untilled lands. They just can't continue to look down on something that has risen rapidly to fourth or fifth rank as an income producer for landowners of the county. That's the story in Clarke. Sweetgum trees, including the limby, unshapely, hitherto despised types, have suddenly found themselves in a new and different economic atmosphere, rubbing elbows with the tall, proud pines, with cotton and livestock.

How did it happen? A number of circumstances has given rise to a rather unique industry, the production of storax, a fragrant, balsamic gum that exudes from the bark of the sweetgum and is used in medicinal and pharmaceutical preparations such as adhesives and salves. It is also used for incense, for perfuming powders and soaps and to flavor tobacco. Important chiefly in the perfume and drug trades, storax has been supplied for decades

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from China and Asia Minor, where there are closely related species of the same family *Hammamelidaceae* (the witch hazel family). Labor is cheaper in China and so long as shipments could be made uninterruptedly, there was small opportunity for developing American storax. The rapid rise of storax production in this country dates from 1937, when Japan's militant policies first threatened the trade routes to the Orient. Although the Rising Sun has been set for almost two years, the demand for American storax continues good. The best information available leads to the belief that Clarke County is now the highest producing area in the United States, and that up until quite recently the bulk of American production came from this and three neighboring counties of southwest Alabama.

The reason the business took root here can be attributed to several factors. Undoubtedly the maximum flow of gum is obtainable in the warm, moist area along the southern margin of the tree's American range. Another factor would be the opportunity-alert farmers of Clarke County. Collecting storax requires lots of elbow grease, not to mention the back and shoulders, or the leg work to reach hundreds of scattered trees over a terrain that is almost entirely mountainous. Clarke farmers are not allergic to hard work. When the war brought shipbuilding jobs to Mobile, 60 miles away, many worked nights in the shipyards, farmed in the daytime, and used the rest of the time for sleeping and commuting.

Another factor that probably gave the business impetus was the fact that some operators had produced storax during the first World War period and for a time afterwards. Thus there was a background of experience.

C. W. Skipper, a Clarke County farmer whose storax collecting has grown until it is now his chief farm operation, smiles when he recalls the first World War period. "Storax got up to several dollars a pound at one time," he relates, "but I was too busy raising 40-cent cotton to fool with it. When the bottom dropped out of cotton I started working gums, even after the prices went down to 30 cents a pound."

Actually, the name "sweet gum" seems more appropriate for the product than the rather unfamiliar term storax. Years ago, country boys used their knives to dig out bits of the exudation from wounds in sweetgum trees. In this manner they obtained their chewing gum.

Were the reader to have some storax put before him, chances are he would think, "What a delightful fragrance; I'd like to have some of this stuff around

just so I could get a whiff of it occasionally." The interest of the Chinese in using storax and developing it for commerce is readily understandable. The Chinese have always had an appreciation of incenses and fine aromatics.

At first thought, it might be natural to regard the working of gums for storax as an operation similar to turpentining. In a general way it is. A 200-year-old industry like naval stores naturally has methods and equipment that are fully standardized. Storax producers do not follow exactly the same procedures and the very little equipment they employ is more or less home-fashioned.

O. C. Helms, county agent of Clarke County, can sketch a better picture of storax production than anyone else. As the product has risen in importance in his county he has given increasing attention to the problems of obtaining better yields, conserving the operations, and marketing wisely.

A farmer seeking information from Helms on how to work his gum trees for storax would be told: "Storax is produced from sweetgum trees only. Yearly yields of one-half to one pound a tree can be expected with efficient operation. The yield per tree seems to be in direct proportion to the green leaf surface. Often trees that are forced or have short stubby trunks and big brushy tops are no good for timber production but produce profitable amounts of gum for sale.

"Operation in a new grove (or orchard as it is called locally) gets under way in the spring about the time the leaves reach full size. Production is started by peeling trees from eight inches and up in diameter. On trees up to 18 inches, a bar of bark four to eight inches wide should be left undisturbed. The other bark is cut in a ring about two feet from the ground and peeled down to the ground. Care should be taken not to bruise the wood.

"After peeling it is necessary to scrape the gum from the face every 14 to 21 days, and then at the upper edge of the face put a new ring in the bark, cutting only a thin slice, preferably a quarter to three-eighths of an inch. The original ring and this regular cutting is done with a tool made by local blacksmiths very similar to a turpentine hack.

"The gum is collected by scraping it from the face of the tree with a cup made from sheet metal or valley tin with the front or scraping edge reinforced with a piece of heavier material. It is not necessary to use a cup on the tree as is the case with turpentine production, as the gum balls up and sticks to the face.

"In Clarke County one man can operate 1,500 to 2,000 trees a year. One tree will continue to

produce three to five years, and young healthy trees will then grow new bark all over the face and continue their growth for lumber or pulpwood purposes.

"When the gum is scraped into a small container it is usually transferred to five-quart oil cans with home-made handles. When collected in sufficient amounts it is heated over a slow fire made in a trench in the ground, with constant stirring to prevent scorching.

"Processing for market, which includes heating, straining, and canning, is the most tedious operation in the production of storax. High flames must not come near the gum, as it is very inflammable when hot. When all the gum in the container is thoroughly melted down to a thickness of molasses it is strained into 50-pound lard cans, ready for shipment."

Helm's thoughts naturally reflect the apprehension of his farmers that temporary strong demand will lead to overproduction, thereby causing prices to drop so low that the work would only be followed by persons whose economic opportunities are very limited. Clarke farmers know that gum trees are abundant; they realize that production could increase considerably from one season to the next. They remember when prices were so low as to make operations unprofitable.

At the present time many Clarke families depend upon storax for a substantial part of their living. The estimated yearly value of this forest product shipped from the county is around $200,000.

While aware of the pitfalls in producing too much gum, Clarke farm leaders realize that a sufficient quantity should be supplied to meet all normal demands with a reasonable price. This is sound policy, as the markets for American storax will be encouraged to the greatest extent, and uses perhaps expanded.

Is good forestry jeopardized through the working of gum for storax? As a general thing, Helms believes not. If the gums are suitably shaped for veneers and good lumber, they can be sold after being worked out. A great many of the trees being worked in Alabama tend to be the limby types that enjoy no premium for timber. When a limby or twisted gum can put a dollar or more yearly into a farmer's pocket, it is very good forestry. Low-grade gums, ordinarily forest weeds, become prize trees.

The pleasant fragrance of this gum balsam deserves a final mention. When advertisers extol the flavor of various pipe tobaccos, they are probably right. They do have something in their tobaccos—something, no doubt, from a lowly gum tree.

Frozen Meats

Condensed from the Pennsylvania Farmer

R. U. Blasingame

AT THE 3rd annual frozen food conference, which was held at Pennsylvania State College this past fall, recent developments in the freezing of meats were discussed by P. T. Ziegler and Paul Margolf. Prof. Ziegler pointed out that the storage of meats at sub-freezing temperatures is not new. "It is simply reaching maturity," he said. "While reaching this stage, the past 7 years, the main obstacle has been the failure to exclude oxygen, which reacts with the fat causing oxidative rancidity. Wrapping materials which have a low moisture-vapor transmission characteristic are desirable because they would be practically air tight. Foils and films (cellophane) seem best suited because in addition to the above they can withstand low temperature without cracking, are non-absorbent, odorless, non-toxic, and are stain proof.

"Our present knowledge indicates that zero is the highest temperature to use. Experiments are being carried on where it is believed the optimum temperature will vary from – 10 to 20°F. Experiments to date show the length of holding in freezing temperatures is a tenderizing process. Aging for periods exceeding six months should be discouraged for there is no economic justification."

Meat that is to be stored should be trimmed of fat, said Prof. Ziegler. The fat probably won't be eaten if it is palatable, and it will taint the lean meat if it oxidizes and takes up storage space.

Pepper and sage appear to have antioxidant qualities, but freezing weakens the sage flavoring if mixed with sausage. It is recommended to mix the sage, pepper and salt together after the sausage has been thawed before cooking. Thus time and energy will be saved.

The freezing of cured and smoked hams and bacon has not been successful. Better flavor was retained in the smoked and cured ham and bacon held at 50 to 70° F. Freezing appears to retard enzymatic action that produces good flavor.

Liver and scrapple were stored

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for six months at zero temperature. At the end of this time the liver was more edible, fresher and did not become as dehydrated as the scrapple.

The antioxidants tested so far are primarily concerned with the sweet life of shortening and in retarding the rancidity in cured and smoked meats.

Glazing eliminates freezer burn (dehydration) but must be repeated every 2 to 3 months. The principle itself is wrong since the addition of fat is one of the causes of oxidation.

Prof. Margolf in discussing poultry stated that refrigeration may improve quality but its prime purpose is to maintain the existing quality. That quality depends on feeding formula length of fattening period, live inspection for health, methods of killing (electrocution or severing jugular vein) and temperature of water when defeathering. It also permits poultry products to be held from seasons of over-production to seasons of less production.

"Poultry should be placed in a freezer before distribution takes place to the extent of impairing quality," said Prof. Margolf. "The birds are placed in an ice slush bath at 35° F where air is forced through. The action of air expedites chilling."

Microbiological contamination caused by eviscerating poultry need not cause alarm because bacterial growth produces no odors or flavors and is not sufficient to decrease quality.

A freezer with air temperatures ranging from 0 to 20° F or any method of freezing that retains a natural bloom on the birds is adequate. The freezing rates for poultry are not as critical as they are for some cut of meat and certain fruits and vegetables.

Poultry may be eviscerated by any one of three methods: warm, after chilling, after freezing and defrosting. In the latter method, if desired, birds are dressed or treated with a spray in five hours which is effective in storing birds for six months.

If poultry is frozen in a storage room, boxes should be lined with stripping with a minimum of one inch, at least an inch of space at the sides. A temperature of 0 to 5° F from three to four days should be allowed for freezing boxed poultry. Then remove the stripping and pack the poultry in tight to minimize air movements thereby reducing drying up. Low temperature air tunnels offer best possibilities in freezing.

It is hoped that tin cans ranging in size from 12 broilers to capon capacity will once again return to the market. These cans reduce air space to a minimum.

What Will Corn Be Like 50 Years From Now?

Condensed from Capper's Farmer

Edgar Anderson

It is a long way from the corn we got from the Indians to the great golden cylinders of raw-tasting hogfood which dominate our national economy today. Out of the long, narrow flints from the north and the chunky-eared, soft dents from Mexico, in a little over 100 years we have bred a new specialized American corn. It is productive, standardized, worse than tasteless as human food, efficient in producing the maximum number of fat hogs per man hour, per acre.

What may we do in another 50 or 100 years? Corn is more variable, more plastic in man's hands, than any other crop plant, yet there are limits to what can be done with it. There may be thousands of kinds of corn in the world, big, little, early, late, slender, squatty; but all of them are corn. However much we may vary the details, they are all built on the same general ground plan.

Take the matter of the tassels for instance; in one kind or another they may have many branches or few, they may be dense or open, deep purple, or red or green. If there were a demand for ornamental ones it would be easy to breed a variety with such deep rich colors, set off by contrasting stamens, that it could be used for decorative purposes, as was so often done by the Indians.

What is the general ground plan of corn upon which we would have to work and outside the limits of which we could not reasonably hope for success? While it will be news to most people who have looked at it only casually, corn is in reality a highly branched grass with a large number of potential ears. Strip the leaves from any ordinary Corn Belt hybrid or inbred and examine the underlying framework. Pull off each leaf carefully and pull away all the husks one by one from beneath the ear. When this is done we find to our surprise that each ear is at the summit of a short but many-jointed branch, and that at all the lower joints of the main stalk there are similar branches, becoming smaller and smaller as one goes down the plant. Only the upper ones ordinarily bear ears, but one has only to remove

Condensed from Capper's Farmer, Topeka, Kansas, May, 1948

the tassel and the ear from the young plant to demonstrate that all these lower branches are potentially capable not only of producing each an ear but even of making extra ears on the branch joints which go out from the main stalk. Such kinds of many-eared corn are known; Ladyfinger popcorn is a conspicuous example, and some tropical varieties take advantage of this latent branching tendency in the corn plant.

In addition to having branches well up on the stem, corn, like many grasses, can tiller or sucker from the base. It is a folk-belief without any data to back it up, that such suckers are tapping the strength of the main stalk. Studies on sweet corn production would suggest that far from being a deterrent these suckers are piling up additional nourishment and under some conditions may even serve as a source of extra food supply for the ears on the main stem!

For the last century we have carefully selected away from branching and tillering. Were we wise in doing so or just prejudiced? In the drouth-resistant corns of the Pueblo Indians in the Southwest, all this branching and suckering was made use of. Many Indian varieties bear long handsome ears but the plants themselves are short and highly branched with many short tillers around the base. A single corn plant with its long narrow leaves, its ears set close to the ground, looks like an ugly little bush to the critical eye of Corn Belt farmer. But when the hot dry winds blow across the field, these low sloppy plants with their sheltering tillers are less affected than his tall hybrids with their widely-spaced, handsomely-arching leaves.

If we are willing to admit that some other type of corn might fit the changing conditions of the Corn Belt, what type may we eventually be breeding for? To answer this question intelligently we would need careful work on a number of basic problems. If corn is to be picked with some kind of a mechanical picker how many ears do we want per plant and what size and shape? Given the right kind of picker it would be just as efficient to harvest 5 or 6 small ears as to pick a big one.

As to ear shape, those who have digested their geometry know that if you increase the length of a cylinder the resulting increase in its volume is directly proportional. If, however, you add to the diameter of the cylinder by the same amount, the resulting increase in the volume is very much greater. Two inches added to the diameter will increase the volume as much as 4 inches added to the length; a 3-inch increase in diameter equals a 9-inch increase in length, and

so on. In terms of corn yield this means that an ear which is half again as long as another one will only yield half again as much, but if it is half again as *wide* it will yield over twice as much.

So if we are to build our corn for the future we will have to know how it is going to be harvested. We also will need to know from unchallengable data, and not from mere prejudice, what is the best height for a corn plant and whether or not it should have tillers. Then, too, what color should it be? The distribution of plant color types in Latin America would make us suspect that there is a dull purple-green type which is particularly effective under cool conditions, another narrow leafed one with bright red on its lower leaves that seems suited to hot and dry situations. As to the kernel we already know that the yellow endosperm is tied up with vitamin values, but what about the blue purples of the aleurone and the various brick reds of the pericarp? Here there are scattered data to suggest that these brighter colors might have their practical uses in spite of our puritanical shunning of anything so gay in a crop plant. Here again, we cannot plan intelligently for the future until we have sound, water-tight data on the subject.

If we do not yet have the information to say what the corn of the Corn Belt will be like in another 50 years, we can at least picture one of the things it *might* be. It might be shoulder high, bearing 2 or 3 short, chunky, many-rowed ears on the main stalk. It might have deep-colored kernels . . . and bear 1 or 2 small tillers at the base of the plant, the leaves being long and narrow with a distinct reddish cast. But who can tell—in 50 years we may be growing a super-sorghum.

Dairy Barn Insulation

Condensed from New Jersey Agriculture

W. C. Krueger

WINTER losses of milk production in a typical dairy barn in North Jersey averaged close to $5 a day in a 60-day study conducted last winter.

Insulating and ventilating such a barn would pay for itself in 2 or 3 years through increased milk production, the study indicated.

The test was sponsored by the National Mineral Wool Association in order to make a comparison between what happens to a dairy herd in a modern barn, and a herd in a rather typical barn as found on many New Jersey farms.

The modern barn, located in Hunterdon County, was built in 1937 as a low cost project to replace a barn destroyed by lightning which in turn had replaced a conventional barn destroyed by fire. The barn is one story, insulated in side walls and ceiling with mineral wool, and enclosed inside and out with fire-resistant cement asbestos material. It is mechanically ventilated by two thermostatically-controlled exhaust fans.

The other barn, in Sussex County, is considered representative of a typically better-than-average dairy operation. It is a partial bank barn, two-story, gable-roofed, timber-framed. The bank wall is of stone and the exterior finish of the remainder is single vertical boarding. The single-board walls, the 7-foot backwall of stone and the overhead hay mow constitute the protection against cold.

There is no positive ventilation system. Air exchange is obtained through windows and the many construction leaks. The usual practice on extra cold nights is to shut the barn up tight, with hay and silo chutes the only air outlets. Even these are blocked with burlap bags on occasion.

The 60-day testing period began in each barn on Feb. 12, 1947. Both farmers agreed not to vary rations fed during the test. Automatic temperature and humidity instruments were installed in the barns for a continuous record. Outdoor conditions were recorded from minimum-maximum thermometers read three times daily. Milk weights were recorded at each milking. Milk

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New Brunswick, New Jersey, November–December, 1947

records were computed on the basis of a 26-cow herd in each barn, although the Sussex herd had more cows than this.

During the test period, ending April 12, outdoor temperatures on both farms were quite similar. The lowest temperature at the Hunterdon County farm was 6 degrees and at the Sussex farm it was 2 degrees. The warmest was 76 degrees at both farms on the last day. It was freezing or below on both farms on 55 out of the 60 days.

Barn temperatures were a different story. In the insulated barn, temperatures remained fairly uniform, never going below 43 degrees. In the other barn, temperatures fluctuated more rapidly, in one instance varying between 38 and 58 degrees in one 24-hour period.

In the modern barn, the relative humidity was much lower, reaching or exceeding 85 percent on only 11 nights. In the old barn, humidity was 85 or over on 30 nights. Condensation was heavy on the stone wall during most of the test period. After cold nights both walls and ceiling were wet with condensation and the first morning chore was to open doors and windows to air out the barn. Work under such barn conditions was not pleasant.

Severe weather in previous years usually caused some sickness in the Sussex herd. This year the cold spell brought sickness to nine cows, causing death to the best producing cow in the herd and necessitating the sale of three others.

The Hunterdon barn remained dry throughout the test with the exception of two days when moisture collected on windows, door and foundation curbs.

As might be expected, milk production of the herd in the old-type barn fell off continuously during the 60 days. In the modern barn, milk production dropped slightly with the first cold spell and then leveled off, unaffected by further temperature reductions.

If milk production in the Sussex herd had held up as well as it did in the other herd, the net returns from milk at $5.73 per 100 pounds would have been about $289 greater than they were. This figures out at approximately $4.81 per day as the penalty for housing animals in a drafty, uninsulated, poorly-ventilated barn.

To insulate and vapor-seal the Sussex County barn would cost about $288 at present prices. Ventilating equipment would cost about another $225. This investment would soon pay for itself in increased milk production, not to mention the added comfort that would be enjoyed by the labor crew.

We recognize that this test was

not entirely scientific. The barns were located in different counties and while outside temperatures were similar, they were not identical. The Hunterdon herd consisted of grade Holsteins for the most part, while the Sussex herd was mostly purebred and was producing at a substantially higher level. However, the test was as carefully regulated as was possible under the circumstances and we feel that the results are reasonably reliable.

High Gain on Ladino Mixture

In rotation grazing, breeding ewes and lambs gained 446 pounds an acre on Ladino, sweet clover, brome and timothy mixture at the Dixon Springs branch of Illinois Agricultural Experiment Station last season. Year before, the gain was 370 pounds.

From permanent and annual pasture plots the flock gets nearly 9 months grazing. The permanent pasture is in 2 fields of 15 acres each. The high meat-producing mixture was seeded with 2 pounds Ladino, 8 pounds sweet clover, 10 pounds brome and 4 pounds timothy an acre. The mixture in the other field was 5 pounds redtop, 15 pounds lespedeza, 5 pounds bluegrass, and 5 pounds timothy. Sheep on this pasture gained 128 pounds an acre in 1946 but lost in 1947 because they were left on too long.

The experiment includes 20 acres of annual pasture which may be seeded to rye, wheat or oats with sweet clover and lespedeza. Purpose of the test is to find a practical pasture-rotation system that can be adapted to small stock farms.

Rye is usually ready for the flock by late October. After 6 weeks grazing the animals are brought into dry lot and fed silage thru winter. They are put back on rye pasture about the middle of March and stay there until the bluegrass mixture is ready May 1. They remain on the bluegrass for 2 or 3 weeks, and then they are turned on the Ladino field, where they get all they can eat for a month.

The Ladino is given a rest when lespedeza is ready. For the remainder of summer the flock alternates on Ladino and lespedeza. Thus the pastures are protected from overgrazing and maximum gains are put on the flock.

—Capper's Farmer

For the Farmer's Library

The Business of Farming—By Herrell DeGraff, Prof. Agri. Economics, Cornell Univ., and Ladd Haysted, farm journalist. Univ. of Okla. Press. $3.00.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean, School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $3.50.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State College. College Book Co. $4.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.50.

Dairy Science—By W. E. Petersen, Ph.D., Assoc. Prof. Dairy Husbandry, Univ. of Minn. J. B. Lippincott Co. $4.50.

Diseases and Parasites of Poultry—By Edgar Hugh Barger, D. V. M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition. $3.75.

Commercial Poultry Farming—By T. Burr Charles, Dept. Poultry Husbandry, Univ. of N. H., and Homer O. Stuart, Dept. Poultry Husbandry, R. I. State College. Interstate Printers & Publishers. $4.00.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $6.00.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. $3.50.

Grow Your Own Fruit—By M. G. Kains, formerly U. S. Dept. of Agri.; Prof. of Horticulture, Penn. State College. Greenberg, Publisher. $3.50.

Livestock Judging Handbook—By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The Interstate Printers. $3.25.

Natural Principles of Land Use—By Edw. H. Graham, Chief of Biology Div., Soil Conservation Service. Oxford University Press. $3.50.

Fur Farming for Profit—By Frank G. Ashbrook, Fish & Wildlife Service, U. S. Dept. Int. Orange Judd Publ. Co. $4.00.

Pay Dirt—Farming and Gardening with Composts—By. J. I. Rodale. Devin-Adair Co. $3.00.

The Earth's Face and Human Destiny—By Ehrenfried Pfeiffer, Director Bio-chemical Research Laboratory, Dornach, Switzerland; foreword by Sir John Stapledon. Rodale Press. $2.75.

Practical Farming for the South—By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of N. C. Press. $3.00.

Profitable Poultry Keeping—By H. Clyde Knandel, Head, Dept. Poultry Husb., Penn State College. Orange Judd Publ. Co., Inc. $3.00.

Starting Right with Turkeys—By G. T. Klein, Extension Poultryman, Mass. State College; edited by Ed Robinson. The Macmillan Co. $2.50

Successful Poultry Management—By Morley A. Jull, Professor and Head of Poultry Dept., Univ. of Maryland. McGraw-Hill Book Co., Inc. $3.50.

The "Have-More" Plan—By Ed and Carolyn Robinson. The Macmillan Company. $3.49.

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BOOKS OF INTEREST

MALABAR FARM — By Louis Bromfield, author, lecturer, farmer conservationist; illustrated by Kate Lord.

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Publishers: Harper & Brothers 405 pages $3.75

COUNTRYMAN'S COMPANION — Collected and arranged by David B. Greenberg, author, farmer; decorations by Jack Wilson, artist.

Here is a treasury of farm literature from ancient to modern times, written to give you exciting reading and good counsel. The book is full of "farm life adventures, such as sheep raising in Montana, mowing hay in up-state New York, horse raising in the West, bee-keeping, stories on everything from earth-worms, beans, poultry and cattle, to axe-helves and threshing machines." The *Countryman's Companion* presents country life as an art, as a philosophy, and as a practical way of life. The hero of the pieces making up this collection is the dirt farmer. You will want a copy of this delightful volume. It will make an excellent gift for your neighbor.

Publishers: Harper & Brothers 412 pages $3.00

WILD FLOWER GUIDE — By Edgar T. Wherry, Professor of Botany at the University of Pennsylvania. Illustrated by Tabea Hoffmann.

The "Wild Flower Guide" for the northeastern and midland United States makes it easy to locate all important information about any wild flower you find, giving its common name, its scientific name, range and habitat, with suggestions for its culture. The book is beautifully illustrated in full color and in black and white. Over 500 species of American wild flowers are listed and organized for easy identification.

For those interested in Wild Flower Conservation practices on their country places in woodland, meadow or marsh, this will be a most helpful book.

Doubleday & Company, Inc. 202 pages $3.00

THE EARTH'S GREEN CARPET — By Louise E. Howard, author, and associate of Newnham College.

This is a short popular account of the ideas for a reformed agriculture which inspired the work of Sir Albert Howard, formerly Director of the Institute of Plant Industry at Indore, Agricultural Adviser to States in Cenral India and Rajputana, and author of "An Agricultural Testament." Lady Howard writes convincingly for those interested in human welfare and in the use made by man of the earth's rich mantle of verdure, the source of his food and of his raw materials, and without which mankind would vanish from the surface of the earth.

Rodale Press 253 pages $3.00

"TO EXIST AS A NATION
TO PROSPER AS A STATE
AND TO LIVE AS A PEOPLE
WE MUST HAVE TREES."

Theodore Roosevelt